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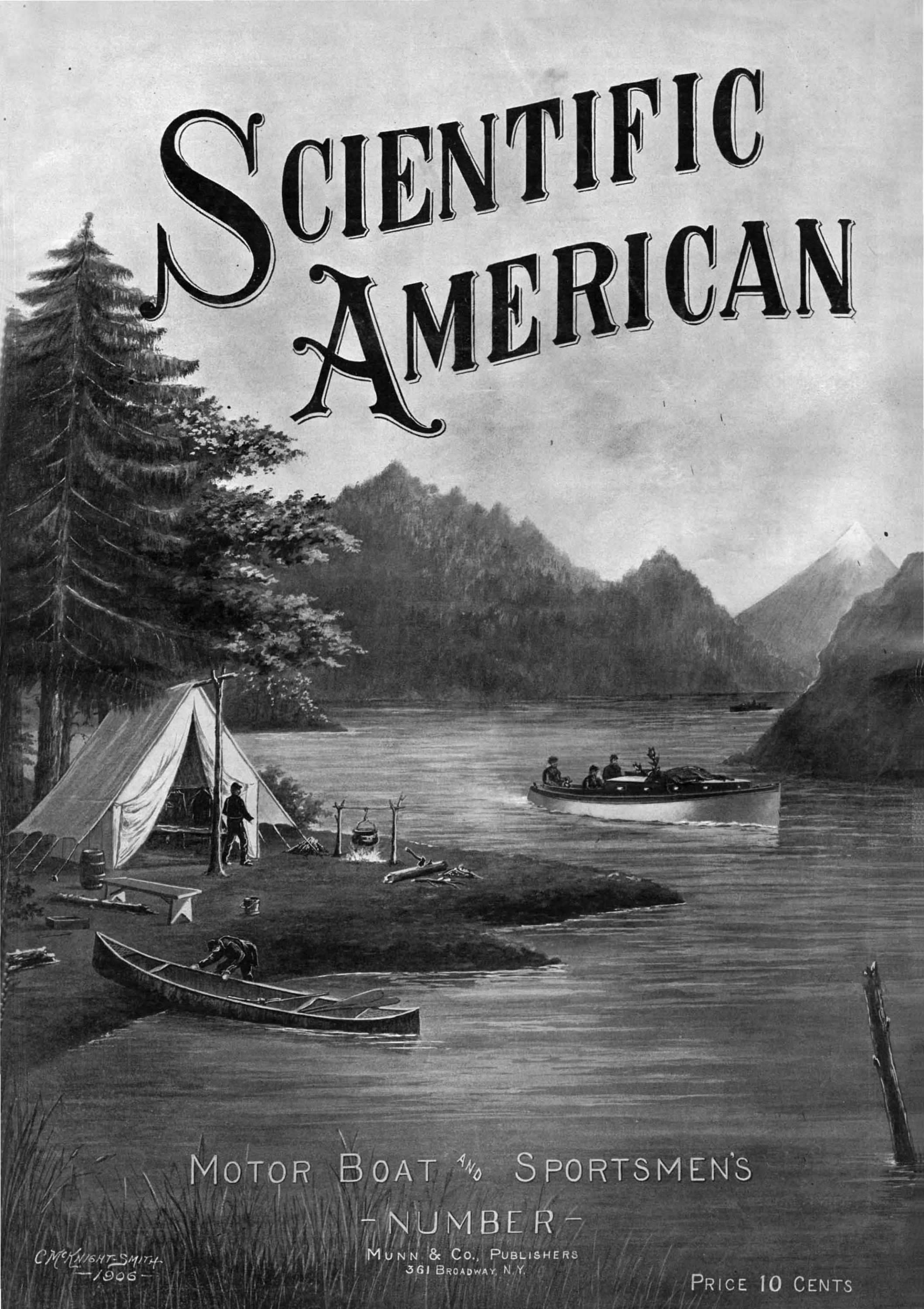

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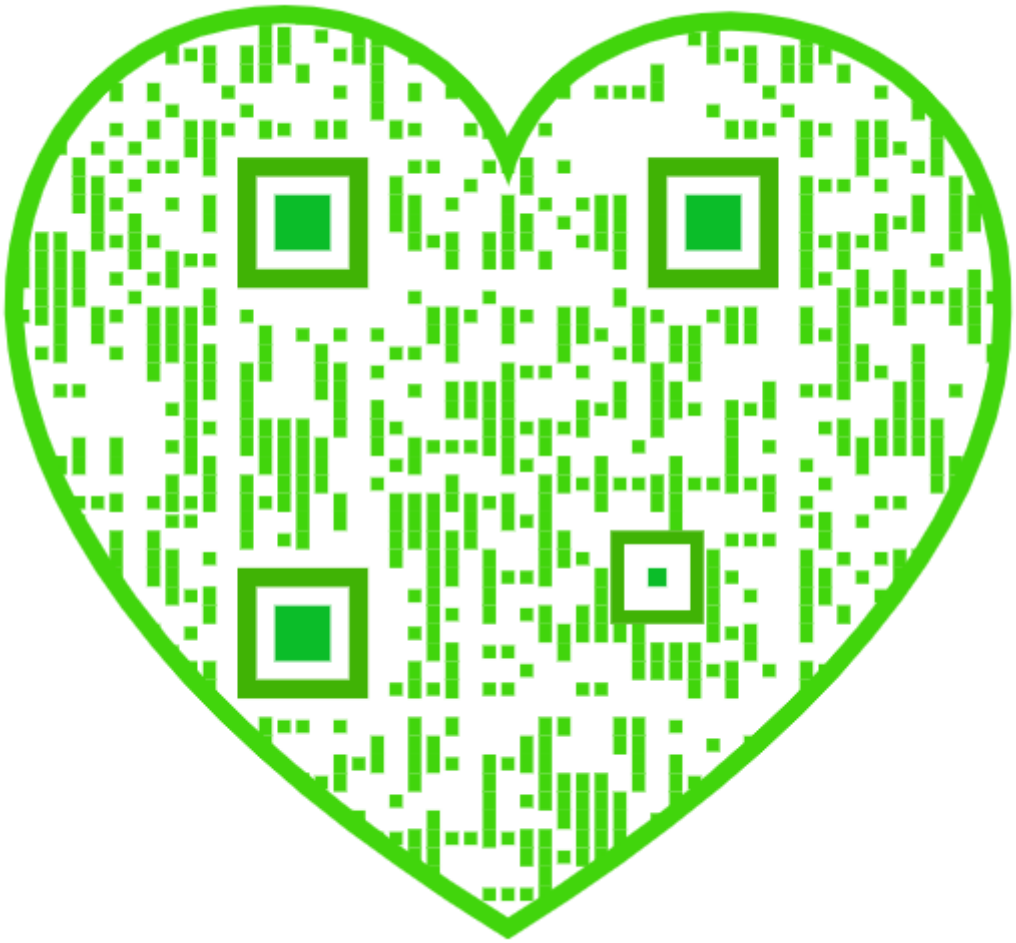

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INCREASE IN ASSETS, over	18 Million Dollars
PAID POLICYHOLDERS DURING 1905, over	14 Million Dollars
TOTAL PAYMENTS TO POLICYHOLDERS to December 31, 1905, over	107 Million Dollars
CASH DIVIDENDS and Other Concessions not Stipulated in Original Contracts and Voluntarily Given to Holders of Old Policies to Date, over	6 Million Dollars
NUMBER OF POLICIES IN FORCE, nearly	6 1-2 Million
INCREASE IN NUMBER OF POLICIES IN FORCE, over	1-2 Million
NET INCREASE IN INSURANCE IN FORCE, over	113 Million Dollars

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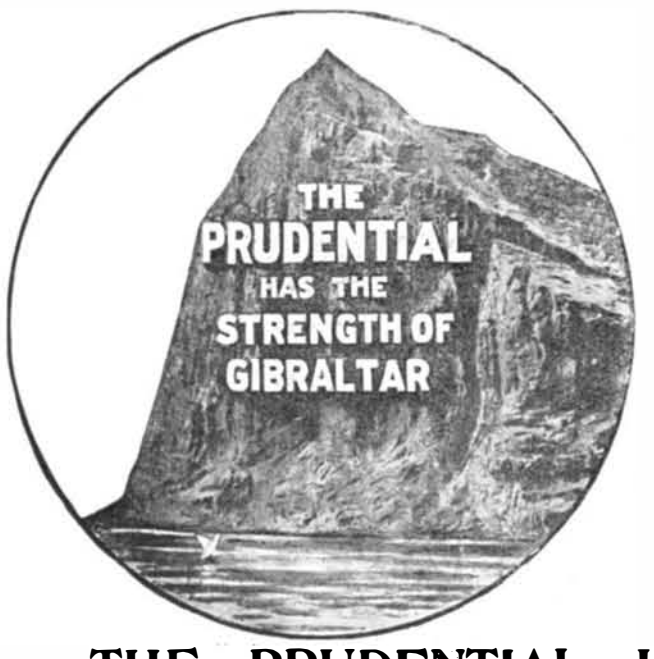

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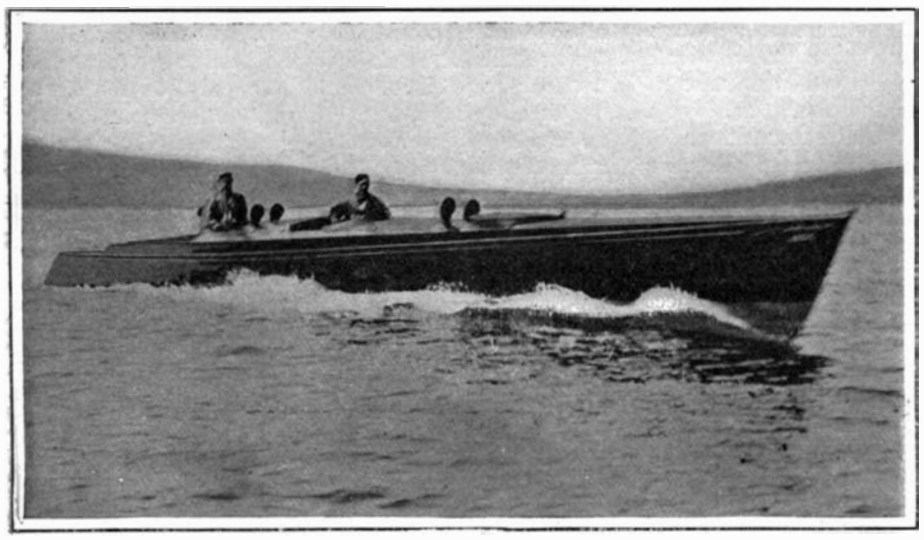
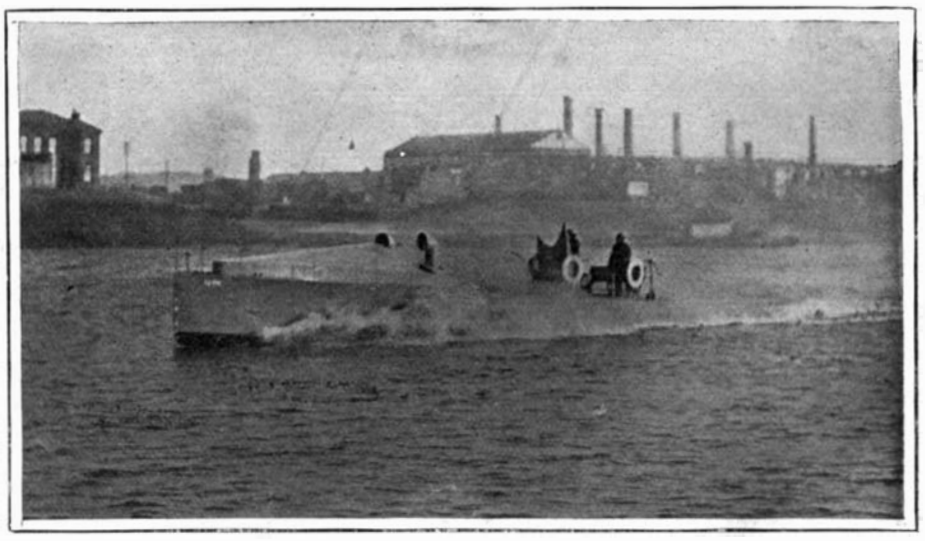
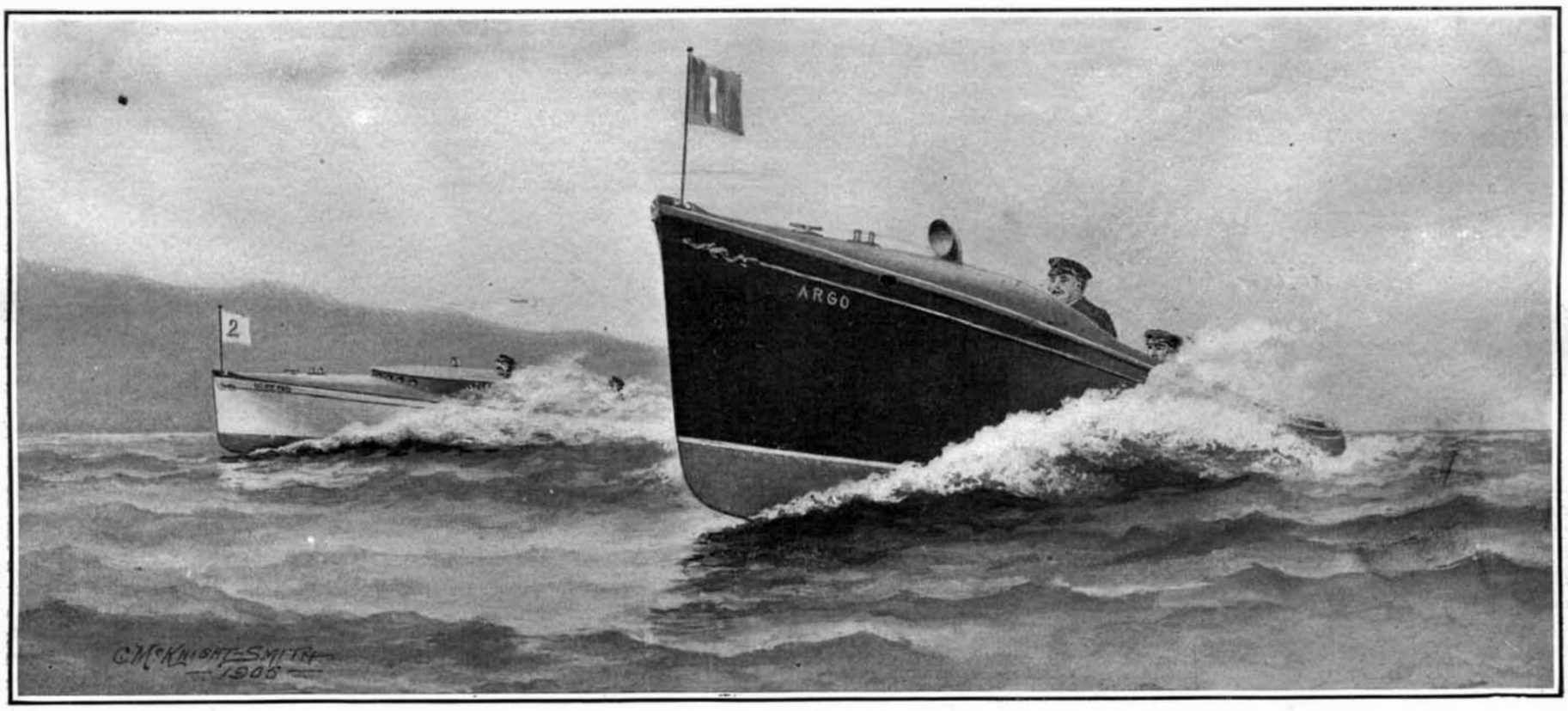


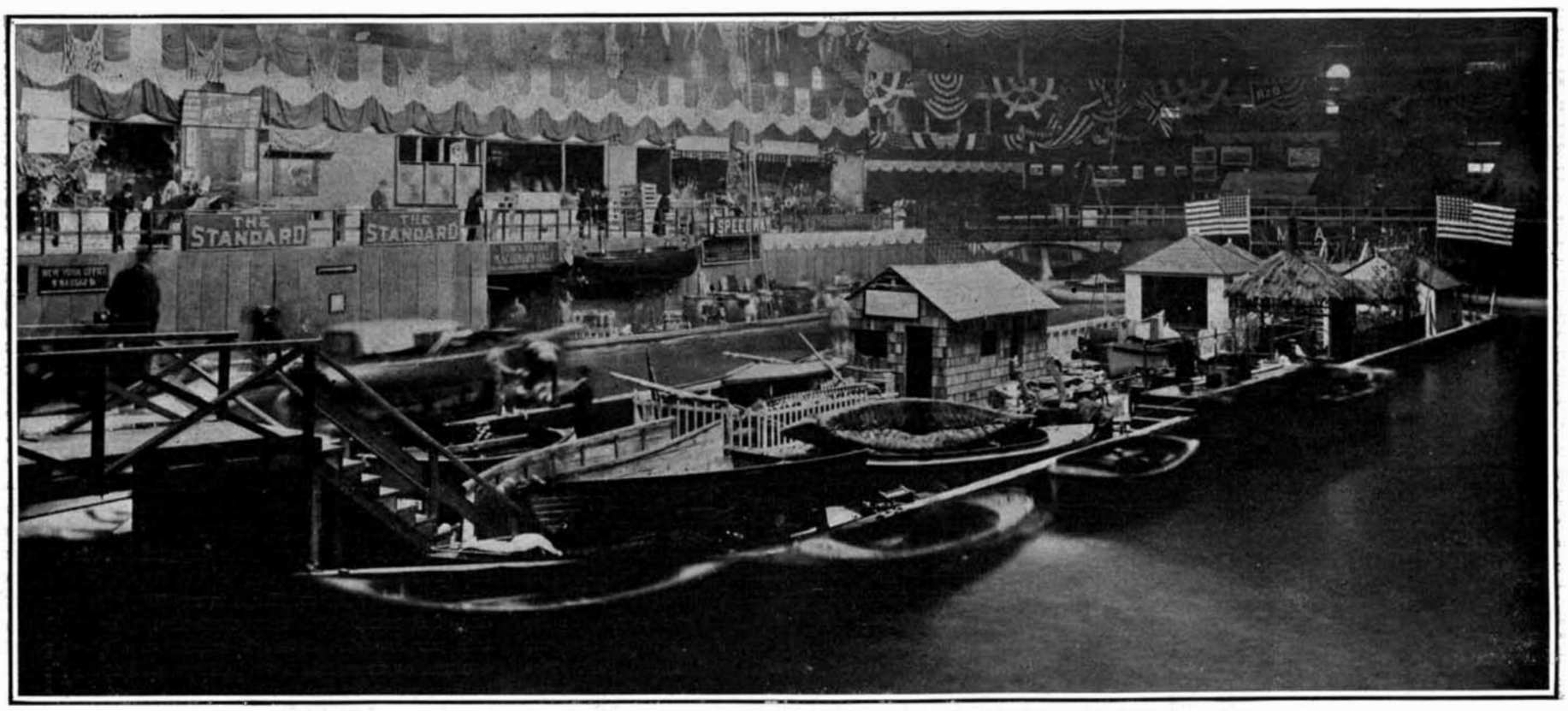
A TYPICAL HIGH-POWER MOTOR BOAT UNDER WAY.



TRIPLE-SCREW MOTOR TORPEDO BOAT BUILT BY YARROW. SPEED, 25½ KNOTS.



THE "ARGO," WHICH MADE A RECORD OF 31.7 MILES PER HOUR ON JULY 4, 1905, IN A SPEED TRIAL ON THE HUDSON RIVER.



A SCENE AT THE SPORTSMEN'S SHOW HELD IN MADISON SQUARE GARDEN, NEW YORK CITY.

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ESTABLISHED 1845

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NEW YORK, SATURDAY, MARCH 3, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

FOR A HIGH-LEVEL LOCK CANAL.

The letter of President Roosevelt, transmitting to Congress the report of the Board of Consulting Engineers on the Panama Canal, together with the report of the Isthmian Canal Commission and letters from Secretary Taft and Chief Engineer Stevens, marks an important step in the settlement of the vexed question of the type of canal which is the best suited to the conditions at the Isthmus of Panama. The letter of the President leaves no doubt whatever that he is strongly in favor of a high-level lock canal. Furthermore, an analysis of the vote taken both by the Board of Consulting Engineers and by the Isthmian Canal Commission, to say nothing of the individual opinion of the Secretary of War, and the present Chief Engineer of the Canal, establishes the fact that the judgment of the majority of American engineers is in favor of a lock canal.

On the other hand, we must not lose sight of the fact that, if we take toll of the strictly engineering opinion of the many able minds that have been requested or appointed by the President to give their ripe judgment on this question, we find that a majority have given their vote in favor of a canal at sea level.

Thus, of the thirteen members of the International Board of Consulting Engineers, eight report in favor of a sea-level and five in favor of a lock canal; while of the six members of the Canal Commission, five are in favor of a lock canal, and one in favor of a sea-level canal. This, on the face of it, would show a balance of nine for and ten against a canal at sea level; but of the five members of the Canal Commission that voted against the sea-level canal, two, namely, the chairman, T. P. Shonts, and the governor of the canal zone, Charles E. Magoon, are not engineers. Therefore, the strictly engineering vote will stand nine in favor of a sea-level canal, and eight against it; and of these nine three are American engineers. Among the American engineers the opinion stands three in favor of the sea-level canal and eight in favor of a high-level canal with locks.

The majority report of the Board of Consulting Engineers recommends a canal at sea level with one tidal lock, having a bottom width of 150 feet, enlarged to a bottom width of 200 feet where the slopes are nearly vertical, and with a depth of 40 feet. The estimated cost is $247,000,000, and the estimated time of construction twelve to thirteen years. The minority report, which is indorsed by the Canal Commission and by President Roosevelt, calls for the construction of a lock-and-lake canal, embodying many of the features of the Lindon W. Bates plan as published in the SCIENTIFIC AMERICAN, February 3, 1906. It contemplates the erection of an enormous dam at Gatun, 7,700 feet in length, 135 feet in height, and to contain 21,200,000 cubic yards of material. There will be a 500-foot wide channel at sea level from the Atlantic to this dam, where there will be built a double flight of three locks, by which vessels will be lifted into the huge artificial lake, 85 feet above sea level, formed by the dam. The waters of the lake will spread over a vast area, and will back up through the valley of the Chagres, affording unrestricted navigation (that is, navigation independent of the channel) for a considerable part of its length. Its waters will extend through the Culebra divide, in a cut 200 feet wide, to Pedro Miguel, where descent will be made by a lock with a 30-foot lift to another lake formed by the creation of a dam in the valley of the Rio Grande. From this lake, which will be at level 55, descent will be made by a double flight of two locks to Panama Bay. The canal will have a minimum depth of 45 feet, and it is estimated that it can be built in nine years at a cost of $140,000,000.

The majority of the board of Consulting Engineers in their report say: "First and foremost, it is essential that the Panama Canal shall present not merely a means of inter-oceanic navigation, but a means for safe and uninterrupted navigation. It is therefore evident that the canal ought to be formed in such a manner that the course thereof shall be free from all unnecessary obstructions, and that no obstacles shall be interposed in that course, whether temporary or permanent, which would by their nature be an occasion of peril and of detention to passing vessels, and more particularly to vessels of the great size which the Panama Canal is (in accordance with the provisions of the law of Congress) designed to accommodate." It is because the majority of the Board consider that locks and locking operations present risks and delays, that they favor, in spite of its greater cost and longer time of construction, the sea-level canal. The minority of the Board favor a lock canal, because they believe it would have a greater capacity for traffic; would offer greater safety and speed for ships because of the deep-water navigation in the lakes; and would involve less time and lower cost of construction.

There is no denying that the economy and quickness of construction of the lake-and-lock canal, and the fact that much of the navigation would be in deep water, render the lock project decidedly attractive. But --and we wish to draw the attention of everyone that shall discuss or vote upon this all-important subject during the next few months, to the serious nature of the doubt—is any one able to state with certainty that an earth dam, 7,700 feet long and with a head of 85 feet of water back of it, can be built to stand on the treacherous foundation of the alluvial substratum of the Chagres valley at Gatun? We have just completed the reading of the late Chief Engineer Wallace's examination before the Senate Committee of Investigation, in which he gives it as his opinion, based upon the elaborate borings, that the conditions for dam foundations at this point are unsuitable, the substratum being an alluvial deposit, in places pervious to water, and extending down 256 feet before firm bottom is reached. Before any final appropriations are made by Congress for a canal whose existence will depend absolutely upon the integrity of this colossal dam, it must be proved beyond a shadow of a doubt that so unsuitable a foundation can carry such a stupendous structure under the great head of water proposed, and do so, not merely for the present generation, or the next, but for all time to come.

THE TRENCH METHOD OF TUNNEL CONSTRUCTION.

It is not unlikely that the well-known method of excavating subaqueous tunnels by means of the Greathead shield will, under certain conditions, be abandoned in favor of a new method which offers very material advantages both from the constructive and the operative point of view. We refer to what is known as the trench system of construction, which was first adopted in a modified form by Mr. McBean, the contractor for the Harlem River tunnel on the easterly branch of the New York Rapid Transit Subway. By reference to the illustrated article published in the SCIENTIFIC AMERICAN of October 31, 1901, it will be seen that the tunnel was built by dredging a trench in the river bottom and building within it a water-tight chamber, from which the mud was removed by the usual pneumatic method, the concrete tunnel being built within the rectangular prism thus provided.

We now learn that an improved application of the trench method is likely to be employed on the important two-track tunnel, which is to carry the main line of the Michigan Central Railroad beneath the Detroit River. The work will be of a magnitude and importance that will rank with that of the tunnels which are now being built by the Pennsylvania Railroad beneath the North River. The new method of construction, however, which has been proposed by Mr. W. J. Wilgus, the vice-president of the New York Central Railroad, differs from that of the North River tunnel in the fact that while the former is being driven by the Greathead shield, the Detroit River tunnel will be constructed entirely in a dredged trench. Moreover, the plan that is proposed will be a marked advance upon the one used for the Harlem River tunnel, inasmuch as the twin concrete tunnel will be built immediately in the trench, without the use of any form of cofferdam or the driving of a single foundation pile. The extreme simplicity, security, and low cost of the system, coupled with the fact that it is proposed to apply it on a work of such magnitude, will constitute this one of the most interesting pieces of subaqueous tunnel work ever attempted.

In the specifications upon which bids will be asked, there are four alternative designs presented, three of which are modifications of the trench method, while the fourth is the usual shield system. The profile of the crossing shows that for nearly 3,000 feet the twin tunnel will extend below the Detroit River, with approaches on easy grades at either end, which together will aggregate a length of about 10,000 feet. The trench method of construction will be adopted upon the stretch of tunnel lying immediately below the river. Briefly stated, it will consist in dredging a huge trench through the mud and clay of the river bottom, and filling it with a monolithic mass of concrete, the tunnels being formed in the mass by means of temporary timber tubes, which are knocked down and removed after the concrete mass has set. In more detail the proposed method is as follows: The bottom of the trench will first be covered with an 18-inch layer of large stones and rock. Upon this will be deposited, from the temporary working platforms, a two-foot bed of concrete which supports, in turn, two lines of saddles, one on the axis of each tube. On the saddles are placed, end to end, large timber cylindrical forms 22 feet in diameter and from 50 to 500 feet in length. These forms are closed at their ends, and when they are placed in line upon the saddles, a space of about four feet is left between each section, for the purpose of dividing the tunnels into separate chambers. When the two lines of forms have been completed for a specified distance, concrete will be deposited in the trench and around the tubular forms until it has been brought up to a level corresponding to a depth of 41 feet below mean water level. The wooden forms will be surrounded with a waterproof covering, either of ⅜-inch sheet steel, or of some of the well-known types of waterproofing. After the concrete has had time to thoroughly set, the end chambers will be entered and the forms knocked down and removed, leaving two circular tunnels 22 feet in diameter, whose length will be determined by the position of the first of the diaphragms or division walls of concrete, by which the tube is divided into working chambers. The inner concrete tubes of the tunnel proper, about two feet in thickness, will be then built in place, these walls being formed with steel reinforcement in the usual well-known manner. When these inner linings or tubes have been completed to the first bulkhead, the latter will be broken through and the work of lining carried into the next section, this being repeated until the whole distance below the river has been traversed.

The advantages of the proposed method of tunnel construction are very material, and affect practically every side of the question. There is, in the first place, a large saving in the time of construction and in the first cost of the work. The risks incidental to all tunnel construction are also reduced to a minimum. Finally, from the standpoint of subsequent operation, there is the great advantage that the tunnel can be built very much nearer to the surface of the river bed, and, therefore, the traffic does not have to be lifted from so great a depth, as the trains are hauled up to surface grade. If the great Detroit River tunnel be successfully carried through on the lines indicated, we shall look to see a very extended application of the trench method. Indeed, it seems to us that, as an alternative method of constructing tunnels beneath the North River, it will become, if it is not already, a subject for careful consideration.

DISTILLATION OF GOLD.

Gold has long been considered one of the most difficult metals to vaporize; in fact, the only known means of accomplishing this is the use of the electric spark.

Prof. Henri Moissan, however, showed as early as 1893 that gold is rapidly set boiling in the electric furnace, as much as 40 grains of the metal being distilled in the time of a few minutes. He recently resumed his experiments in this direction, and an account of these is found in a communication to the French Academy of Sciences. The metal is shown to boil readily in the furnace at a temperature of 2,400 deg. C., 100 to 150 grains being converted to the gaseous condition within two or three minutes. By condensing the vapor on a cold body, either filiform gold or small cubes of crystallized gold are obtained. Like copper, gold at its boiling temperature is found to dissolve a small amount of carbon, which is freed again in the shape of graphite at the moment of solidification.

Gold is, however, less volatile than copper. In fact, when heating both metals under the same conditions, the latter is found to boil in a much shorter time than gold. The chemical properties of distilled gold are identical with those of hammered gold or of melted metal reduced to a fine powder. There is thus no indication of the existence of an allotropical modification of this metal.

Moissan also investigates alloys of gold and copper. There being no definite compounds of these, the copper is found to distill before the gold, and the same is true of gold-tin alloys, which were next studied. When collecting a large amount of the vapors given off from a boiling gold-tin alloy, the tin is found to burn at contact with the atmospheric oxygen, yielding tin oxide of a purple color, due to the fine gold dust condensed at its surface. This is nothing else than powder of Cassius. The same method can be used to obtain purples with different oxides, such as silica, zirconium, or magnesium oxide, lime, and alumina. The boiling point of gold, while higher than that of copper, is found to be lower than the boiling point of lime.

THE HEAVENS IN MARCH.

BY HENRY NORRIS RUSSELL, PH.D.

The very clear evenings which sometimes occur at this season of the year give us our best chance to see what is really the largest, though one of the least known, parts of the solar system—the zodiacal light. Anyone who looks westward on a clear, moonless evening, as soon as it has become really dark, and the twilight has faded from the west, will see that the background of the sky is brighter in some places than in others. By glancing rapidly across from southwest to northwest, he can easily satisfy himself that this brighter region has the shape of a slowly tapering cone, with its base on the western horizon, above the sunken sun, and its apex lost in the Milky Way, beyond the Pleiades. This light is fully as bright, in its lower portions, as the Milky Way itself, but differs from it in character, being quite soft and uniform, while the Milky Way, even to the naked eye, is patchy and full of faint specks of light.

That this light has its origin in our own system, and not among the stars, is fully proved by its characteristics. In the first place, it lies along the plane of the earth's orbit (which nearly coincides with those of the other planets), and this alone would lead us to suspect a solar origin. But the conclusive proof is that it moves with the sun, appearing always in those constellations that lie near the horizon after sunset. Since it lies in the plane of the ecliptic, these constellations are always members of the signs of the zodiac —whence its name.

In the tropics, the zodiacal light is visible at all seasons of the year, after sunset and before sunrise. But in our latitude it is only well visible when its central line rises most steeply from the horizon, and this happens in spring for the evening light, and in autumn for the morning.

In very clear skies, it is possible to see that the cone of light does not run out to a point at all, but extends quite across the sky as a faint, narrow band, which connects the brighter portions visible in the evening and the morning.

A very satisfactory explanation of these facts is given by the hypothesis that the sun is surrounded by a great swarm of meteorites, shaped something like a convex lens, which lies about in the plane of the earth's orbit, and whose thin edge extends somewhat beyond the earth. It is the light reflected by these meteorites that we see.

This accounts for everything. The light grows wider and brighter toward the sun, because there are more meteors there, and we look through a greater thickness of the swarm. The thin edge, projecting beyond the earth's orbit, gives us the faint zodiacal band which connects the brighter portions of the light, and the whole affair must obviously follow the sun in its apparent motion through the heavens. A further confirmation of this theory has recently been provided by Prof. Newcomb, who, observing from a high mountain in Switzerland, has seen the zodiacal light at midnight in the north, and so determined that the widest part of the region of meteorites extends about 30 deg. from the sun.

How big these meteorites are we cannot say. They cannot be large bodies, astronomically speaking, for if they were more than a few miles in diameter, they would be visible separately in our telescopes.

But beyond this we cannot go. It is probable that, like the meteorites which strike the earth from time to time, they are of all sizes, from many tons weight to grains of sand.

THE HEAVENS.

The evening skies in March are very fine. Starting in the west, we see Taurus, still at a good altitude, which, besides Aldebaran and the Pleiades, now contains Jupiter, the brightest object in the sky. To the left of it is the splendid Orion, and farther on, in the southwest, is Canis Major, marked by the superb Sirius, and an irregular cross of bright stars further south. Higher up is the isolated bright star Procyon, in Canis Minor, and above this is Gemini, with the two bright stars Castor and Pollux, from each of which a row of fainter ones extends toward Orion.

North of Gemini, in the Milky Way, is Auriga, with the very bright yellow star Capella. Below this, still in the Milky Way, is the bright group of Perseus, and the zig-zag line of Cassiopeia.

Returning to the south, we see below Sirius, and to the left of it, a part of the great southern constellation Argo. The sky to the east of the meridian is less brilliant. The most prominent group in the east is Leo, marked by the "Sickle"—which cannot be mistaken, even by a novice—and by a triangle of bright stars below. Between Leo and Gemini is Cancer, notable only for the star cluster Praesepe—a fuzzy patch to the naked eye, but a group of small stars to a field glass. Below this is a small but rather conspicuous group which marks the head of Hydra—a huge constellation which extends southeastward to the horizon, but contains only one bright star.

In the east the larger part of Virgo has risen. North of this is Boötes, with the bright red star Arcturus. Ursa Major is admirably displayed high in the northern sky. The Bear's head and fore-paws have almost reached the meridian, while the end of her tail is still on a level with the Pole star. Ursa Minor and Draco, which lie below, complete the list of the conspicuous constellations.

THE PLANETS.

Mercury is evening star in Pisces. On the 18th he is farthest from the sun, and about this date he can be best seen. This is an unusually favorable occasion for seeing him, as he is north of the sun, very bright, and does not set till about 7:30 P. M. Toward the end of the month he gets too near the sun to be well seen. On the 27th he is in conjunction with Venus, but both planets are too near the sun to be well seen.

Venus is also nominally an evening star, but she is so near the sun that, except at the end of the month, she is practically invisible.

Mars is evening star in Pisces and Aries, setting at about 8:30 P. M. in the middle of the month. Jupiter is likewise an evening star, being in Taurus, between the Pleiades and Aldebaran, and remaining in view till near midnight.

Saturn is morning star, but is too near the sun to be well seen. Uranus is in Sagittarius, and rises about 2 A. M. on the 15th. On the 29th he is in quadrature with the sun, and comes to the meridian at 6 A. M. Neptune is in Gemini. He is also in quadrature, on the 28th, and comes to the meridian at 6 P. M.

THE MOON.

First quarter occurs at 4:20 A. M. on the 3d, full moon at 3:09 P. M. on the 10th, last quarter at 6:49 A. M. on the 17th, and new moon at 6:44 P. M. on the 24th. The moon is nearest us on the 12th, and farthest away on the 28th. She is in conjunction with Jupiter on the 2d, Neptune on the 5th, Uranus on the 18th, Saturn on the 22d, Mercury and Venus on the 25th, Mars on the 27th, and Jupiter again on the 29th.

On the evening of March 2 the moon passes between us and the bright star Aldebaran, occulting it for about an hour. As seen from Washington, the star disappears behind the moon's dark limb at 10:30 P. M., and reappears at the other side of the moon at 11:30. The times will be different at other places of observation, but not greatly so for places in the Eastern States.

At 8 A. M. on the morning of March 21, the sun crosses the celestial equator, and enters the sign of Aries, and, in the phrase of the almanacs, "spring commences."

Princeton, February 19, 1906.

SIXTY MILES AN HOUR ON THE WATER.

BY ERNEST ARCHDEACON.

Builders of motor boats have realized for a long time the tremendous difficulties met with when they attempt to increase the speed of their craft even slightly, in view of the fact that the resistance of the water and, consequently, the power necessary to propel the boat increases with the usual type of hull as the cube of the speed.

During the last few years it has become possible to attain an increased speed with a motor of a given power by so shaping the hulls that their speed of translation tends to lift them partly out of the water, so that when the speed increases the resistance of the water increases much less than heretofore on account of this lifting of the hull, which, according to some constructors, reaches about thirty-three per cent of the total displacement of the boat. This is quite the *dernier cri* of motor-boat construction.

Over two years ago one of my countrymen, M. le Comte de Lambert, succeeded in constructing a boat which, in place of causing the emersion of about one-third of its hull from the water, succeeded in bringing the entire hull upon the surface. At this moment the resistance to the boat's advance became sensibly null. This boat is not a Utopia; it was built and operated over two years ago. The principles which its constructor followed were discovered a number of years ago by a Swiss scientist, M. Raoul Pictet, who carried on dynamometric experiments of the highest interest. These experiments were carried out on Lake Geneva with hulls of boats furnished with inclined planes; and they demonstrated accurately the phenomena of gliding and also the invariability of the effort of traction, at all speeds, as soon as the gliding was obtained.

Let us now return to the De Lambert hydroplane boat. (This boat was illustrated in the SCIENTIFIC AMERICAN of October 7, 1905.) The boat is constructed in a very rudimentary fashion. It is, according to its builder, too heavy and full of defects, as is generally the case with a first experimental apparatus. Nevertheless, with a 13-horse-power motor, it attained a speed of 35 kilometers (21¾ miles) an hour—a speed which was several times taken by official chronometers. It was two years ago that this boat was experimented with without any mishap or serious drawback; and the results of the experiments were given to the world.

It is hard to believe that in view of these results motor-boat builders have done nothing as yet toward the construction of a boat built on these principles—a boat which seemed destined to create a revolution in the line of speed craft.

On the contrary, however, they have been too much preoccupied with increasing indefinitely the number of horse-power possible to place in their hulls. We have actually reached the point of placing 300 horse-power in a walnut hull in order to attain a speed of 31 miles an hour at the most. We are now awaiting the 500 horse-power motor-boat engine.

How blind these builders are not to see that with 20 horse-power and a hydroplane they will attain the same speed as is possible with 100 horse-power in the regular hull; and that with 300 horse-power—I do not dare to predict the speed!

To continue the discussion in a simple manner I will say that a well-constructed hydroplane can be made to attain sensibly the same efficiency as an automobile. But, in the actual state of the science, a 100-horse-power automobile will travel 90 miles an hour! Notwithstanding the lack of energy of boatbuilders in adopting a new idea, I am willing to bet, and I am ready to stick to it, that before September 1, 1907, 55 miles an hour will be made on the water. And I am surely below the truth.

The theory of the hydroplane, which is, moreover, identical with that of the aeroplane, is the following:

Any inclined plane moving in a fluid, air or water, and which has a horizontal movement of translation, undergoes an ascending or descending reaction according as the inclination of the plane is ascendent or descendent with respect to the direction of travel.

But, the hydroplane is nothing more than a boat to which has been added a suitable series of inclined planes. Before starting, the water which the apparatus draws, as well as its displacement, will be maximum. As soon as it is under way it will commence its movement of ascension, which will only cease when it attains such a position that the draft of water becomes zero, and the displacement also.

With Count de Lambert's boat, the inventor estimates that as soon as the speed reaches 15 kilometers (9.31 miles) an hour, the emersion is already complete. Moreover, he states that as soon as this emersion is obtained, the effort of traction no longer varies whatever may be the speed. From this we reach the conclusion that the force necessary for the propulsion of an emerged hydroplane increases exactly as the speed. At very high speeds this theorem will no longer be quite exact, since the resistance of the air will not then be negligible; but with speeds up to 20 miles an hour we are altogether free to neglect this.

Let us now calculate from these figures what power Count de Lambert's hydroplane requires in order to emerge completely. We have, evidently,

$$\frac{x \text{ (power sought for)}}{13 \text{ horse-power (total power of motor)}} = \frac{15\ k}{35\ k}$$

whence

$$x = \frac{13 \times 15}{35} = 5.5 \text{ h. p.}$$

Therefore, the boat used 5½ horse-power in order to rise from the water at a speed of 9.3 miles an hour, after which the increase of speed obtained was exactly proportionate to the increase in horse-power, i. e., in the proportion of 5.5 horse-power to 13.

It will be easy to construct a boat not weighing as much as that of Count de Lambert's (which weighed 800 kilogrammes, or 1,763 pounds), when fitted with a motor of 50 horse-power. Making the calculation in the manner as above, we have

$$\frac{5.5}{50} = \frac{15}{x}$$

$$\text{whence } x = \frac{15 \times 50}{5.5} = 136 \text{ kilometers (84.45 miles)}$$

an hour.

I should add immediately that at these speeds the resistance of the air becomes quite important, and, as the calculation no longer holds exactly, the figure given above must be diminished considerably, although it would still remain quite high.

I believe that I have shown in a satisfactory manner the immense interest to be had in building and experimenting with well-constructed hydroplanes, and I repeat that I do not understand the apathy of the boat builders.

I know that the criticism will be made that the hydroplane will not work in turbulent water since the planes would strike the waves and not glide over them. This opinion is not altogether true, as I have found from my own experiments with the hydroplane that it is not stopped by the waves any more than is an ordinary boat.—Translated for the SCIENTIFIC AMERICAN from La Vie Automobile.

Casein Cement for Porcelain.—Mix 10 parts of recently prepared casein with 30 parts of soluble silicate of soda and 20 parts of similar silicate of potash.—Nouvelles Scientifiques.

HYDROPLANE BOATS: LATEST TYPE OF HIGH-SPEED CRAFT.

BY WILLIAM M. MEACHAM.

Under normal conditions the resistance which a boat encounters is, in round numbers, proportional to the *cube* of the speed and may be divided into three classes: (1) Skin or frictional resistance. (2) Eddy-making resistance. (3) Wave-making resistance.

The power expended in driving a boat is used largely in overcoming these resistances and is found to vary as the *cube* of the speed.

The only conceivable method of avoiding this condition is to lift the boat from the water by a means having less resistance than that of the boat when supported by displacement. The hydroplane offers this solution, and the following proposition aims to set forth its scientific basis, and to show that the power required to drive a boat on this principle varies in a much smaller ratio than the accepted formula above recited:

> Given a flat plate, having weight which is constant under all conditions, deeply submerged in water, drawn edgewise, horizontally through the water, with front edge in direction of motion, raised at a small angle to the horizontal.
>
> The power applied to the plate is divided into two components, one of which furnishes the supporting force, and the other of which overcomes frictional resistance.
>
> I have found that the component of supporting force varies as the square of the speed. The component of frictional resistance also varies as the square of the speed, as demonstrated by experiments of Toëssel and Froude.
>
> It then follows that if the supporting force is kept constant by reducing the width of the plate, across the line of motion, as speed increases, the frictional resistance of the plate, taken as a whole (not as per unit of area), remains constant.
>
> Or, in other words, if the area of the plate is varied (in width across the line of motion) inversely as the square of the speed, the resistance due to skin friction and that due to the inclination of the plate will remain constant, and the supporting force will also remain constant. Since the resistance is constant and the distance through which the force acts varies directly as the speed, the power required will vary directly as the speed instead of as the cube of the speed, as would be the case if weight was supported by displacement.

Such would be the result under ideal conditions only. Count de Lambert, and others, with apparatus similar to that herein pictured, succeeded in raising the boat out of the water at high speed, the hydroplanes becoming partially emerged and gliding upon the surface. Such an arrangement, however, of large supporting plates at the surface, serves to produce, in considerable degree, the very resistances to be eliminated and thus, to such extent, to defeat the very purpose for which it has been designed.

With the object of substantiating the principle of the hydroplane, the writer has experimented with *submerged* plates.

The apparatus used was crude, but it will be seen from the photograph that even at the moderate speeds attained, not over 15 miles per hour, the submerged hydroplanes operated successfully to raise the hull of the boat entirely out of the water.

In the experiment pictured there were but two hydroplanes used, one at the front and one at the stern, in size 15 by 30 inches and 18 by 36 inches respectively. The balance was preserved by a small outrigger on either side. At another time the same apparatus (identically) was tested with a load of two men instead of one with the same result as shown. In the latter instance the total weight, made up of the boat and two men, was exactly 550 pounds. By computation it will be seen that the total supporting hydroplane area was 7⅛ square feet. By careful measurement it was ascertained that the water displacement of all submerged parts was less than three per cent of the total weight.

Special attention is directed to the fact that the surface of the water was scarcely ruffled, except from the regulating plate projected at the front, by means of a rigid bar, for the purpose of regulating or varying the angles of the supporting plates. The plates used in these experiments were excessively large on account of the necessity of working at low speeds with little power.

The outline drawings will convey a fair understanding of an apparatus designed to reveal this principle

The body of the boat, *A*, when at rest, is supported by displacement at the water-line, *J*. When the boat is put in motion, by the propeller, *H*, the regulating plates, *C C′*, which have hung submerged, are caused by their angle to the line of motion through the water, to rise and remain at the surface.

This lifting of the regulating plate, *C*, at the front end of the boat, causes arm, *P*, to turn on pivot, *d*, which operates the connecting pieces, *K*, *L*, and *M*, and raises the front edge of supporting plate, *B*, which is pivoted at *Q*, causing the angle of plate, *B*, to increase in relation to the horizontal.

The position of plate, *B*, when boat is at rest, and until its position is changed by the regulating effect of plate, *C*, is nearly horizontal, being curved slightly downward from front to back; but as soon as its front edge is raised, by the operation of the regulating plate, *C*, as above explained, a lifting force is produced which, when the speed is sufficient, causes the boat to rise. A like result is simultaneously accomplished by the supporting plates, *B′ B′*, at the rear end of boat, which are regulated by the plates, *C′ C′*, in a similar manner.

The boat is balanced at all times by the automatic and immediate adjustment of this rear mechanism. The level of the boat from front to back is likewise automatically maintained.

When the boat is put in motion, it steadily rises until it has attained the maximum speed, at which time the body of the boat is raised entirely above the surface of the water, and there maintained by the automatic adjustment of supporting plates, *B B′*, which is accomplished by their respective regulating plates, *C C′*, which, still held at the surface of the water, have gradually become lower, relatively to the boat, as the boat has risen in and above the water, with a corresponding lessening of the angle of the supporting plates *B B′*, which have, finally, at maximum speed, come to their position of highest efficiency.

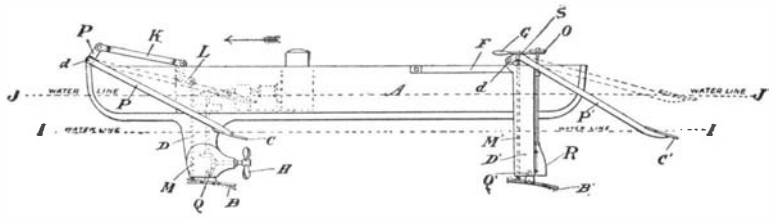
As the speed may thereafter vary, any tendency to sink, because of lessened speed, is immediately overcome by the lifting effect of the automatically increased angle of the supporting plates, *B B′*, the said angle being immediately diminished as the speed is again increased.

This process, repeated, provides for indefinite duration, and when, finally, the speed is slackened, the gradual sinking of the boat is accomplished, automatically, by the reverse operation of the regulating plates, *C C′*, and the supporting plates, *B B′*, by which it is brought to a position of rest, when it is again supported, as at first, by water displacement at water-line, *J*.

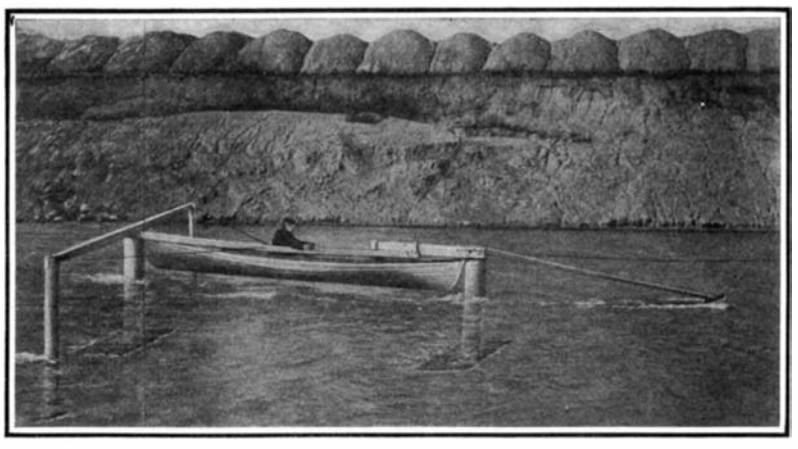
The water-line, *I-I*, indicates the relative positions of various parts when the boat is at full speed and maximum height. Letters *D D′* show the hollow, elliptical, supporting frames to which the supporting plates, *B B′*, are attached, and in which the connecting rods, *M M′*, operate. Letters *S S* show the pivotal connections between said rods, *M′ M′*, and the rear regulating arms, *P′ P′*. Letters *R R* show the rudders, which, attached behind the rear supporting frames *D′ D′*, are operated by the lever, *G*, and cross-pieces, *O O*, by means of a chain. Letter *F* indicates the necessary wood or metal framework for rigidly connecting and supporting the rear portion of mechanism.

The supporting frame, *D*, at the front end, contains, in addition to the rod, *M*, the necessary shaft, gearings, etc., for the operation of propeller, *H*.

The supporting plates, *B B′*, it should be noted, are connected at pivots, *Q Q′*, at a point in front of the center, so that the upward pressure on these plates while the boat is in motion, tends to press them to a more nearly horizontal position and thereby operates as an unfailing spring against the pressure exerted



Longitudinal Section of a Proposed Motor Boat Fitted with Automatically-Adjusted Submerged Hydroplanes.



Experimental Test of Submerged Hydroplanes.

The boat, which is being towed at a comparatively low speed, is shown lifted clear of the water by submerged Hydroplanes at the bow and the stern. This type of Hydroplane is said to be more efficient than the surface type shown below.

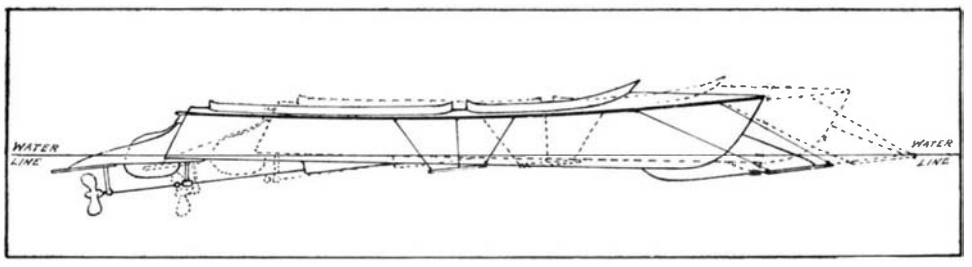
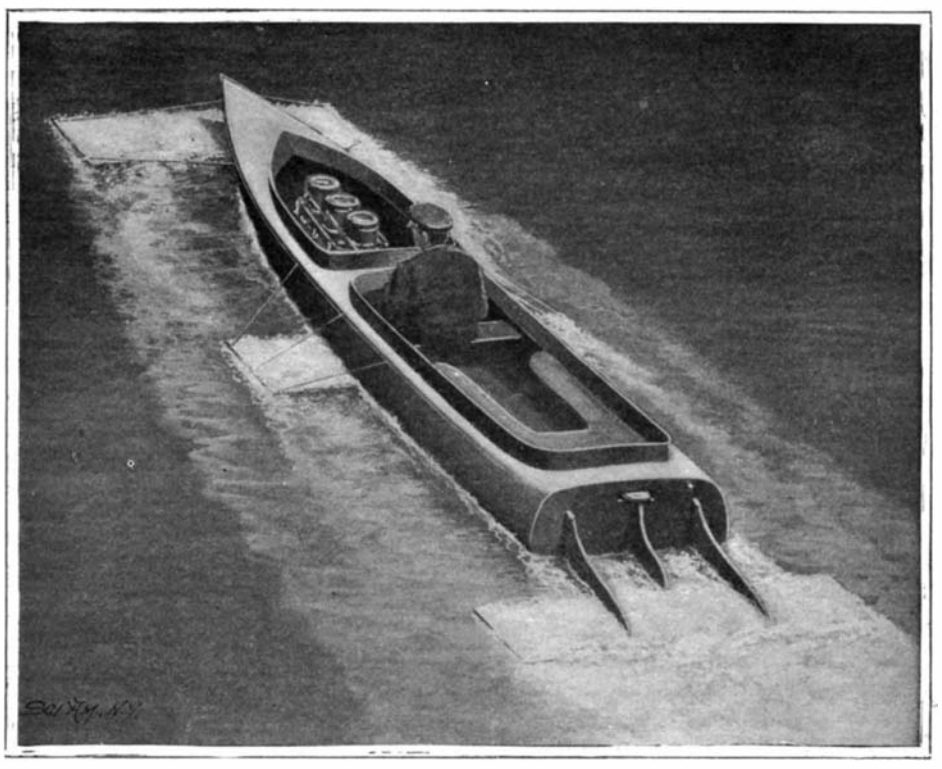


Diagram Showing Positions Assumed at Rest and in Motion by Motor Boat Fitted with Surface Hydroplanes.



Motor Boat Fitted with Three Surface Hydroplanes of the Type Proposed by Archdeacon.

by the regulating plates, *C C'*. It will be understood that in this construction no attempt is made to adjust the plates in width as speed increases; but the advantage of the application of this principle is secured by designing the plates for each particular boat for one speed only (which is its maximum speed), and the lifting force required at other speeds (between starting and maximum) is obtained by the automatic regulating device which gives the plates at all times such an angle as is necessary.

Strange as it may seem, the chief obstacle encountered in early experiments was not to make the hydroplanes rise, but to prevent them from rising too far, and it was as a means to this end that the surface follower, as a regulating device, was adopted. By its use the boat becomes practically a soaring machine and bears the same relation to an ordinary boat, in the water, as does a soaring bird to a balloon, in the air; and this relation holds, also, in respect to their skin friction areas. It also possesses the following advantages over a soaring machine in the air, i. e., it soars in, and its propelling force is exerted upon water, which is seven hundred times as dense as air, while the displacement of the hull, with its necessarily large frictional surface, is all carried in the rarer medium, air, and above the water, the surface of which can be used to effect the regulation of the inclination of the supporting hydroplanes.

Another special advantage of a submerged hydroplane construction is that it will operate without hindrance in water sufficiently rough to totally unfit a gliding boat.

The strength of development and success will depend, not upon disproving or defying any established law, but upon strict application of rational laws and careful attention to details.

A MOTOR PADDLE WHEEL FOR SMALL BOATS.

In the accompanying engravings we give a side elevation and plan view of a detachable stern paddle wheel designed for the propulsion of small boats, and perspective views of the apparatus mounted upon a boat.

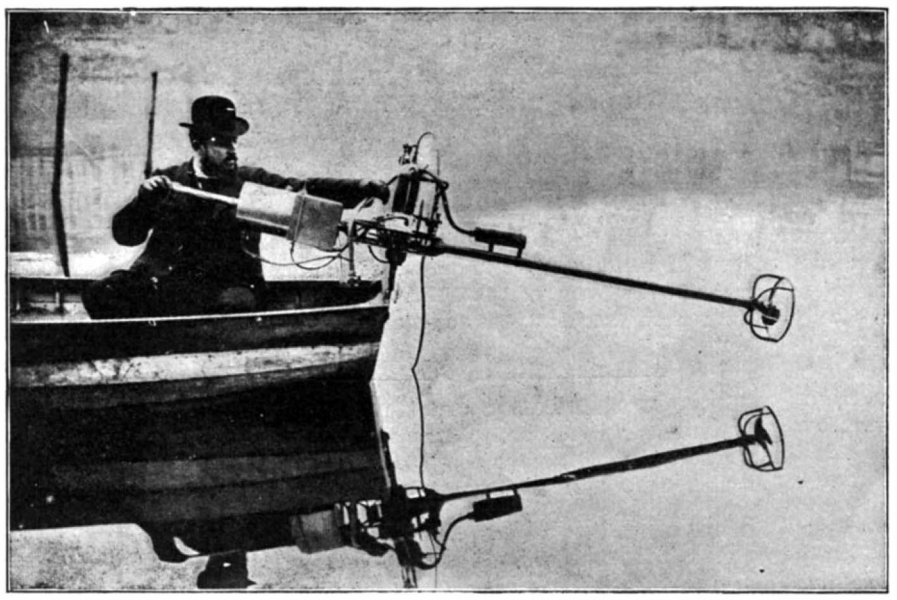
On examining the diagrams from left to right, we observe, at *A*, a two-cylinder de Dion-Bouton motor of 16 effective horse-power; at *B*, a clutch; at *C*, a speed reducer; at *D*, a reversing gear; and at *E* and *E'* sprocket chains connected with the paddle wheel *R*. This wheel consists of paddles inclined at an angle of 50 deg., small spaces being left, so that the stress is exerted upon a wider surface than if the paddle consisted of a single bow, as is usually the case. As the water is easily discharged, it creates no passive resistance, and thus a high efficiency is obtained. As this propeller is designed for Oceanica and has to be actuated by kerosene, the only fuel practical in that country, a special carbureter has been applied.

With this paddle wheel it is possible to carry from 18 to 20 tons of merchandise at a commercial speed of from 5 to 6 miles an hour with an output of fuel not exceeding 40 ounces per horse hour.—Translated from L'Automobile for SCIENTIFIC AMERICAN.

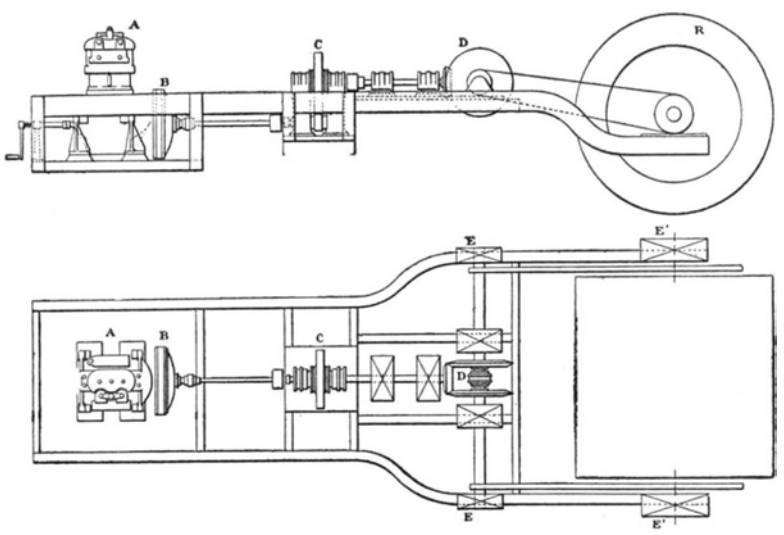
THE "MOTOGODILLE," A MOTOR DEVICE FOR PROPELLING SMALL BOATS.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

An interesting device in the way of applying a motor to small craft has been brought out in France. The apparatus has been designed to afford a very simple as well as inexpensive method of applying a small gasoline motor to boats. It is nothing more or less than a power oar and consists of a motor-driven propeller which is adapted to be placed on the boat; but contrary to other apparatus and motors which require to be specially built and installed in the boat so as to form part of the latter, it forms an entirely separate mechanism which is fitted to the stern of the craft in a few minutes, and which permits the immediate conversion of any ordinary boat into a motor-driven craft without any change whatever in the boat itself. By applying a simple socket-piece to the stern with four screws or bolts, the propelling apparatus, which fits in the socket by means of a pin in about the same way as a steering oar, can be immediately installed. The new propeller device, which is known as the "Motogodille," is of extra light, simple, and strong construction, and forms a single rigid piece having but a single contact with the boat. It serves to propel and steer the craft at the same time and also to change the speed. The socket and the support of the apparatus form a kind of universal joint which allows the pilot to raise the propeller or to plunge it to the required depth so as to vary the speed of the boat, or else to displace it to the right or left for steering. These movements are all carried out with one hand and without any more fatigue than is felt when using a rudder. As the propeller is mounted on a long shaft and works at a distance of 4 feet 6 inches from the stern, it runs in comparatively still water and gives a much better propelling effect than usual. The variable immersion of the propeller shows it to work with a flat-bottomed boat in very shallow water. A speed varying from 5 to 10 miles an hour is obtained (according to the size of motor which is used) with an ordinary boat containing 5 or 6 persons, with a consumption of 0.3 gallon per hour of gasoline. Two sizes are made, one of 1¼ horse-power weighing 35 pounds, and a second giving 2½ horse-power and weighing 90 pounds. A very practical application of the device is upon sailboats, as it will bring the boat into port in case of a calm, and it can easily be stowed in the hold. As will be noticed the motor is mounted upright just over the main pivot which works in the boat. Back of the motor and fixed on the steering bar is a box with sliding cover for the battery and spark coil. Above it is a cylindrical gasoline tank.

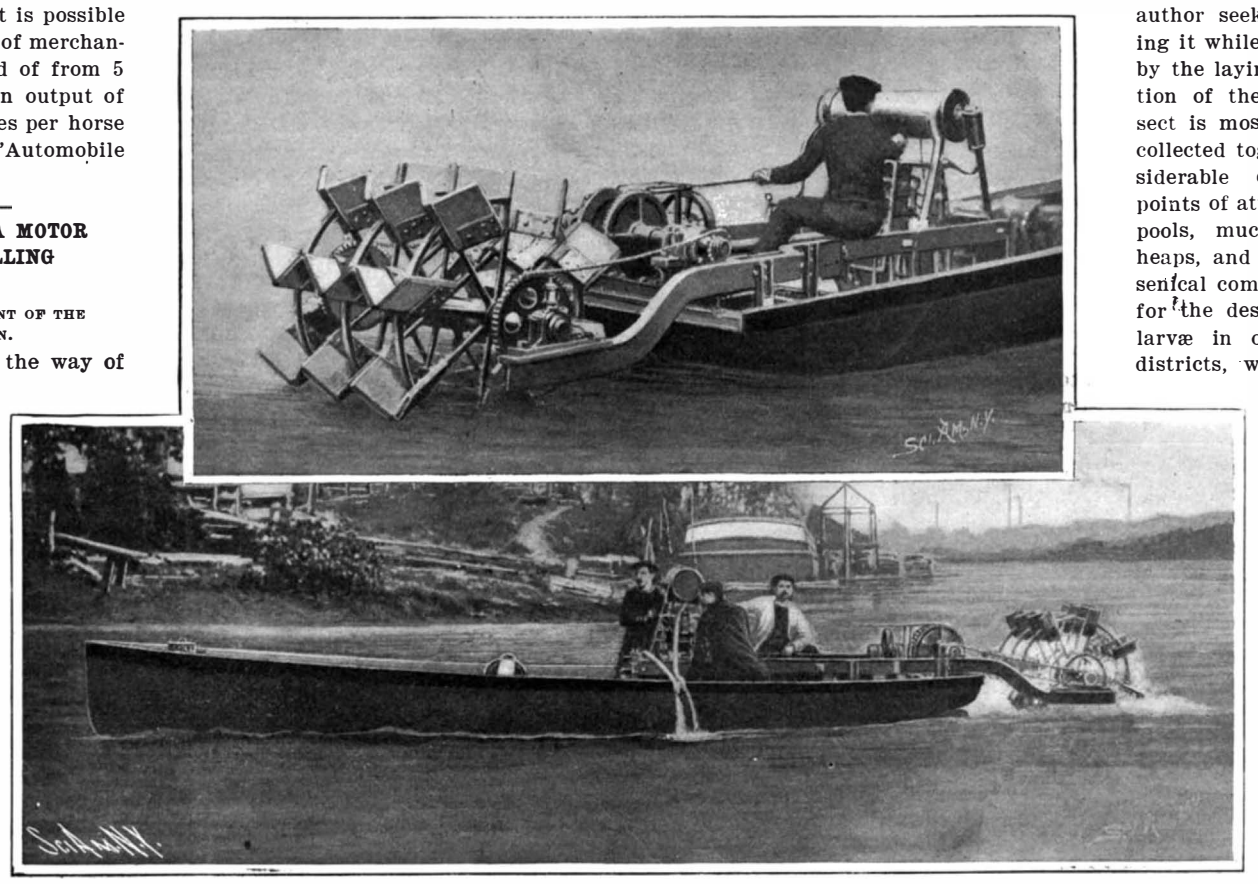


THE MOTOGODILLE, OR MOTOR SCULL, APPLIED TO A SMALL BOAT.



ELEVATION AND PLAN OF THE BUCHET MOTOR PADDLE WHEEL.

THE BUCHET MOTOR PADDLE WHEEL SEEN FROM THE REAR.



SMALL BOAT ACTUATED BY THE BUCHET MOTOR PADDLE WHEEL.

The Destruction of Flies.

The fly is doomed; the fiat has gone forth, and its days are numbered. Doctors have recognized the fact that the house fly is not only a nuisance, but also a real danger, because it is the bearer of microbes and nastiness of all kinds. Fired with the spirit of enterprise, and wishing to do good to humanity at large, the Matin, of Paris, recently offered a prize to the discoverer of the most practical and efficacious means of destroying these insect pests, and thus eliminating one great source of the spread of epidemics.

A pamphlet entitled "Delenda Musca" has carried off the prize.

According to the writer of this essay, very few people are aware that the domestic fly lays its eggs in cesspools, drains, liquid manure, and dung heaps of all kinds. In these delectable media the *Musca domestica* deposits its oblong eggs, which are opened by the detachment of a narrow longitudinal band or strip—much in the same way as the blade of a knife is opened. The larvæ grow with surprising rapidity, attaining their full size, in summer, in eight days' time. One fly may give birth to millions of others, as it breeds continuously for several consecutive months (usually from May to October). Assuming that one specimen lays 200 eggs (containing an equal number of males and females) then, as will be seen from an easy calculation, in six months' time one hundred thousand million flies will be brought into the world to tease bald-headed men and the helpless in general. After showing that it is useless to attack the full-grown insect, the author seeks some means of destroying it while it is in the period covered by the laying of the egg to the formation of the pupa—just when the insect is most vulnerable, and is found collected together in more or less considerable quantities. The greatest points of attention to this end are cesspools, muck heaps, drains, manure heaps, and the like. Arsenic and arsenical compounds should not be used for the destruction of flies' eggs and larvæ in open cesspools in country districts, where—too often, unfortunately—they are in underground or other communication with wells, watercourses, and springs, which might thus get poisoned. Recourse should be taken to some substance which not only dissolves in the liquid contained in the drain, but which will penetrate right into the heart of solid matter. This substance must be of a nature to withstand fermentations and all transformations experienced by the solids contained

in the cesspool, as they are always, in such media, of ammoniacal and reductive nature. These reactions show that it is useless to employ sulphate of iron, sulphate of copper, etc., for although in the beginning these metallic salts might have some effect, they would subsequently become changed by fermentative influences and lose their efficacy. The first trials made showed that ordinary soda, mixed with ordinary chloride of zinc (in the proportion of 5 kilogrammes of each to every cubic meter of matter), was quite sufficient to kill the larvæ and prevent the hatching of further eggs laid in the same place during the season. This process could, if necessary, be used for stationary, hermetically closed cesspools, but it would not do for movable closets, sewage tanks, or open drains. Petroleum was then tried by the author of the pamphlet in question, in the proportion of one liter to every superficial meter; but in a short space of time—due probably to the slight rise in temperature caused by fermentative processes—the petroleum disappeared. This was verified by putting a stick into the cesspool; if petroleum had still been present, it would have left traces thereon. Coal tar was then tried with much better results, although they were still not all that could be desired. The most satisfactory results were secured with raw petroleum or raw schist oil (residue of distillation). Two liters per superficial meter were mixed with water, the whole being well stirred up with a piece of wood. This, on being poured into a drain or closet, will form a stratum of oil which will destroy all the larvæ, while, even should flies not be prevented from entering the drain, at least all the eggs they may deposit will be prevented from hatching. This oil is sufficiently consistent and tenacious to adhere to the walls of drains, to form a coating over solids, and remain attached thereto for a long time. This protective layer of oil also facilitates the development of anærobic bacteria which cause the rapid liquefaction of solids, thus rendering them quite unsuitable as a breeding ground for Diptera. In the case of manure heaps this oil may be mixed with earth, lime, and fossil phosphates, in which state it is sprinkled (preferably in the spring) over all sources likely to tempt young couples of the Diptera family to start housekeeping and the rearing of a family.

Electric Trains for the Simplon.

It was at first proposed to use steam trains in the Simplon tunnel, but afterward the electric system was decided upon on account of the high heat of the tunnel coming from the hot springs and again because it was difficult to ventilate the tunnel and carry off the smoke. The administration of the Swiss railroads has lately accepted the project of the Brown-Boveri electric firm for installing the system of dynamos and rolling stock. The traction will be carried out according to the system which is now in use on the Valtelline road in Italy. The hydraulic power of the Videria and the Rhone which already served for putting through the tunnel, will operate a turbine station and the latter will supply current to a number of sub-stations situated some 30 miles off. In these the high-tension alternating current will be converted to 2,300-volt current for the different circuits. A dam is now building which will be nearly 500 feet long. The head of water is some 30 feet. The main station contains two halls for the turbines, 120 feet long, and the dynamo hall lies between the two. Each of the turbine halls contains four pairs of horizontal turbines. Each unit is laid out for 3,000 horse-power at a speed of 200 revolutions per minute. The turbine shafts pass through the wall and in the dynamo room they have the alternators mounted on them. These dynamos have a capacity of 1,500 kilowatts and generate three-phase current at 25 cycles. Lombard governors keep the speed constant. The three-phase current passes to the transformer hall, where a bank of oil transformers raise the tension to 33,000 volts. For the traffic in the Simplon tunnel it is intended to use five electric locomotives at first, and the electric system is to be extended to all the sections of the Simplon road which are operated by the Swiss railroads, or a total length of 25 miles. The total cost of the electric equipment of the tunnel is estimated at $200,000. It is expected to open the new line about the 1st of May.

The Current Supplement.

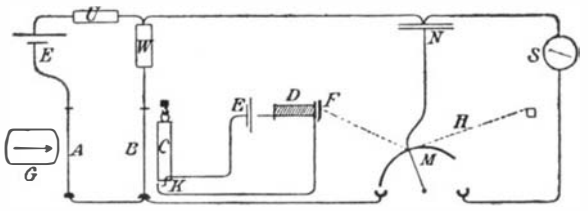
The current Supplement, No. 1574, opens with a summary of the granite industry of New England. Of interest to mining engineers are Dr. Kunz's statistics on the precious stone industry in 1904, and some data on the coal mines of Japan. G. T. Beilby contributes a very interesting paper on gold molecules in the solid state, giving valuable results of most interesting experiments. Some analogies are drawn between light and electric waves, in an article by Prof. B. Dessau. The American Society of Heating and Ventilating Engineers by a strange coincidence happened to hold its annual meeting on January 17, 1906. Two hundred years ago on this very date Benjamin Franklin was born. For that reason the interesting paper which was read before the Society on "Benjamin Franklin, the First American Heating and Ventilating Engineer," should prove valuable. The paper is published in full. At the opening meeting of the Society of Mechanical Engineers, President J. R. Freeman read a paper on the safeguarding of life in theaters. The paper, which is abstracted, is the result of painstaking investigations on the author's part. A simple photographic and photo-micrographic apparatus is so clearly described and illustrated that any one can construct it. Dr. Alfred Gradenwitz writes on a modern testing plant for gasoline automobile motors. Some specifications of material used in high-speed automobile and motor-boat engines are published. A. L. Johnson contributes an excellent paper on steel for reinforced concrete.

SPEED AND ENERGY LOSS OF PROJECTILES IN WATER.

The singular explosive phenomena that are observed whenever rapidly-moving projectiles strike liquid masses have been investigated of late years by many experimenters, and it has been shown that neither the revolution of the projectile nor the heating it undergoes plays an important part. It has likewise been demonstrated that the phenomena are not due to the effect of hydraulic pressure, as the vessel does not explode until after the bullet has left it. In order further to study these interesting phenomena, Martin Gildemeister and Hans Strehl (see Annalen der Physik, Vol. 18) recently undertook tests to ascertain the magnitude of the forces concerned.

The kinetic energy imparted to the liquid is a maximum equivalent to that lost by the projectile as it passes through the liquid bulk, the amount immediately converted into heat being in all probability very small.

The arrangement used by the authors is represented in the accompanying illustration. After first breaking the wire *A*, the projectile causes the condenser *N* to be discharged through the resistance *W*, which is free from self-induction, the discharge ceasing as the second wire *B* is broken. The time elapsing between the two occurrences is calculated from the residual charge of the condenser, its capacity and initial charge



SPEED AND ENERGY LOSS OF PROJECTILES IN WATER.

being known. The following law is derived from the authors' experiments:

The loss in velocity of a projectile in water is proportional to the first power, and the loss in energy to the second power of the velocity of the projectile on entering the liquid.

A New British Range Finder.

The British Naval Department has adopted a new type of range finder, which is stated to be of great value. It is the invention of Lieut. Arthur Vyvyan, the details of the mechanism having been carried out by Mr. Newitt, R.N., an electrical engineer. The utility of this instrument is for automatically transmitting the range observations from the fighting control top to all the various gun positions on board the vessel simultaneously and automatically. There are a series of electric motors, one stationed in the fighting control top, and one at each gun position. These motors all run at a uniform speed, and when there is any movement in the one at the fighting top, the others are similarly affected automatically. For instance, when the officer in the fighting top descries a vessel or object to be brought under fire, he estimates the range, and instructs the officer in charge of the motor appliance. A trial shot is then fired some distance short of the estimated distance, say 400 yards. The instrument is set running for this distance, and by means of an indicator and pointer the range is transmitted immediately to the various gun positions, the instruments at which record simultaneously upon their indicators. Should the range prove too short, another shot is fired, the distance being increased by say one-half the underestimate, viz., 200 yards. The result of this second shot will bring the instrument's pointer to about the correct range. If not, then another shot is fired, the range being again proportionately increased. These trial shots only occupy a few minutes, and directly the correct range has been obtained by the recording officer in the fighting top, all the various gun positions have it as well, and firing can be continued without any delays. The instrument provides automatically for the deflection of the range and the speed of the ship. The transmitter has proved completely satisfactory under test, the correct range being invariably obtained by the second trial shot. It has been perfected during the past year, and is now in operation at the gunnery school at Whale Island and on board a war vessel, and its utilization is to be extended throughout the service.

A TRIPLE-SCREW MOTOR TORPEDO BOAT.

The torpedo boat shown under way in our illustrations is one of the latest productions of the English firm of Yarrow & Co. It is an exceedingly speedy craft, having excellent sea-going qualities and being intended to take the place of the usual steam-propelled second-class torpedo boat. The boat is 60 feet in length by 9 feet beam, and is fitted with triple screws and three four-cylinder Napier gasoline engines—two of 120 horse-power for the outer propellers and a 60-horse-power engine for the center propeller. The last-named propeller is reversible, and it is thought that a single reversing propeller is all that is necessary for this type of craft.

In a series of speed trials made recently this boat developed a speed of 25½ knots when running light. This is an advance of 5½ knots over what could be obtained under the same conditions with a boat having a steam power plant. The reasons for this increased speed are the much lighter weight of the machinery (there is probably a saving of some 50 per cent), and the form of hull, which, at these high speeds, for the displacement of a boat of this type, seems to enable it to skim or glide over the surface of the water—a fact made evident by the small surface disturbance. The power which is usually absorbed in making waves is therefore utilized for propulsion.

A motor boat of this type, if fitted with a revolving torpedo tube, could be readily used as a second-class torpedo boat, or as a gunboat for coast-guard service. On account of its light weight, which does not exceed 8 tons, it is quite easy to transport such a boat on a larger vessel to any part of the world. Regarding the cost of such a boat the statement is made that fifteen of them could be built at the cost of a modern destroyer. For the purpose of defending a port from an attacking or blockading fleet, there is scarcely any doubt that fifteen small, high-speed motor boats of this type would offer a considerably greater means of defense than one destroyer of large size upon which the fire of a number of guns could be concentrated.

In line with the construction of this first motor torpedo boat for the British navy mention should be made of the fact that Mr. Lewis Nixon, who built the motor boat "Gregory," that crossed the Atlantic a year ago and was subsequently sold to Russia, has designed and built for the Russian navy no less than ten of these small, high-speed craft. These are said to have a length of 90¼ feet and a displacement of 35 tons. They are driven by twin screws, each of which is driven directly by a reversible marine gasoline engine of 300 horse-power. A speed of 20 knots is obtained at 400 R. P. M. of the engines.

This is a second example which has occurred within the last five years of how backward our government is in seizing new and worthy inventions as soon as they are brought out. The other case in point is the Lake submarine torpedo boat, which, although tested and found far superior to any other boat of the kind either here or abroad, was abandoned and its inventor allowed to sell it to foreign powers, one of the largest purchasers among these being Russia.

The Color of Water.

L'Illustration (Paris) gives the following results of recent experiments on this subject:

"After long hesitation, scientific men agree to-day in admitting that water *physically* pure, seen in mass, is sky blue. This color is that taken by the white light of the sun when absorbed by the water, in consequence of a phenomenon the explanation of which would be a little long. It is not due to the *chemical* purity of the water, since the sea (which is the bluest water) is also that which contains the most salt. Nevertheless, according to Forel's experiments, the matter in solution should be the predominant cause of the modification of color; upon which act besides the matter in suspension, the color of the bottom, and the reflection of the sky and of the banks. Consequently blue water is pretty rare in nature; a good many seas and lakes that give us the impression of this tint are green. The water at present acknowledged to be the bluest is that of the Sargasso Sea, between the Cape Verde islands and the Antilles. The water of the Mediterranean off the French coast and around Capri is bluer than that of Lake Leman, much less blue itself than that of the lakes of Kandersteg and Arolla, in Switzerland.

"Hitherto they have not exactly determined the relation between the color of water and its degree of purity. The Belgian, Prof. Spring, who has been a long time studying this delicate question, has just communicated to the Academy of Sciences at Brussels some interesting figures. Pure water containing a millionth of ferric hydrate appears brown under a thickness of 6 meters; a ten-millionth is sufficient for it to be green; and, in order that it may remain blue, is needed less than a twenty-millionth. As to humic matter, it causes the blue coloring to disappear in a quantity less than a forty-millionth. The calcic compounds should have a great influence upon clarification, as they eliminate, up to a certain state of equilibrium, the ferric and humic compounds."

Correspondence.

Impracticability of Cement Tiles.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of the 10th instant of the SCIENTIFIC AMERICAN is an inquiry for cement tile, by John R. Spears. He seems to have overlooked the fact that the farm drainage tile is porous, water going through its sides the same as through the earth. Cement tile might be used for glazed tile, for watertight or sewage purposes. Yours truly,

Wayne, Neb., February 12, 1906. C. E. BARTLETT.

A Centigrade Photometer.

To the Editor of the SCIENTIFIC AMERICAN:

I was much interested in the article by Mr. Butzing, "A Unit for Light Measurements and a Centigrade Photometer," in SCIENTIFIC AMERICAN of January 27, p. 91. His suggestions are very good. I would suggest to use a selenium cell in connection with a galvanometer, to indicate the intensity of light on a graduated scale, the same as we read the steam pressure on a steam gage. This photometer might be either permanent, intermittent, self-recording, or not. To save current it might be so made that it could be turned on or off at will. Of course, this photometer would hardly be as accurate as the ones now in use, but for ordinary purposes it would certainly be sufficient, and above all it would be handy. But I would suggest that zero should be absolute darkness, so as to avoid the nuisance of above and below zero. But make it Centigrade by all means.

Is there any chemical that would make paper permanently a fairly good conductor of electricity, so that electricity would pass through it? If paper would not do, I could use cloth. REV. JAMES WALCHER.

Tintah, Minn., January 29, 1906.

[Acetate of lead, sodium chloride, or carbonate, and many other salts dissolved in water and absorbed in paper, will render the paper a fairly good conductor of electricity. If, however, the paper must be dry, these will not answer. Plumbago incorporated in or surfaced upon the paper would perhaps answer the purpose. The question conveys nothing of the use intended, and we are at a loss for an answer.—ED.]

Refractory Lining for Gas-Engine Cylinders.

To the Editor of the SCIENTIFIC AMERICAN:

I have read with a good deal of interest Mr. Howell's interesting article on "A Rational Method of Cooling Gas-Engine Cylinders." It might be interesting to him to know that Mr. C. C. Bramwell, of Hyde Park, Mass., tried this system of piston and cylinder construction on an air-cooled motor for automobile work on ordinary lines early in 1901. That part of the cylinder, where the packing rings were, was made of steel and was unjacketed; the upper part, where the explosion and expansion took place, was of copper.

He found that as far as lubrication, etc., went the motor gave him no trouble, but that it was necessary to water-jacket the head in order to prevent pre-ignition.

It seems to be a generally accepted belief that all the good that a water jacket does is to prevent pre-ignition and make possible the successful lubrication of the cylinder. I have reason to believe, however, that when an engine becomes overheated quite an amount of the loss of power may be caused by the expanding of the incoming charge due to its contact with the cylinder walls and the residual exhaust gases of the last explosion, thus preventing a full charge being taken into the cylinder. It can easily be seen that, if this is so, the higher the speed of the engine the less the loss from this cause would be. The same result could, of course, be secured by opening the inlet valve late in the stroke.

Of course, the first thought that comes to one's mind on hearing this argument for the first time is the matter of the Diesel engine. Now, as a matter of fact, the Diesel engine has not nearly as high a maximum temperature as the ordinary Otto cycle engine, and since an excess of air is always used in this engine it is evident that less heat units are developed from the combustion of the fuel and therefore there is proportionately less heat carried off by the water jacket or other cooling device; hence it is only reasonable to suppose that the mean temperature of the cylinder walls is lower, and therefore we would not be as likely to suffer from this result of overheating as with the ordinary Otto cycle. Furthermore, as in this Diesel cycle an excess of air is always used, this effect of expanding the incoming charge would probably do no harm anyway.

Mr. Howell, however, speaks about compounding. If this were done it would probably be advisable to use all the fuel that the oxygen of the air would unite with and perhaps to begin the admission of the fuel during the last of the compression stroke, thereby departing from the Diesel cycle in these two particulars. This would be necessary in order to get the highest possible terminal pressure so as to get the greatest advantage from compounding. I feel, however, that Mr. Howell's estimate of the possible terminal pressure is somewhat high and that the advantage of compounding is somewhat doubtful. HAROLD H. BROWN.

Boston, January 25, 1906.

Time Signals from Electric Lights.

To the Editor of the SCIENTIFIC AMERICAN:

In modern life it is quite desirable that the people have a simple, inexpensive, and ready method of setting their clocks and watches to the correct time, at least once a day. In many cities and towns in the United States the correct time is distributed daily, by means of government time signals, telegraphed throughout the land at twelve o'clock noon. The Western Union Building, New York, and the Prudential Building, Buffalo, are provided with time balls. The ball drops at precisely twelve o'clock. Comparatively few of the inhabitants of those cities can make use of such signals. These can be seen only from certain positions and directions, and at short distances. Moreover, they can scarcely be seen, at any considerable distance, during rain and snow storms.

It recently occurred to the writer that time signals might be transmitted to nearly all the inhabitants of cities and towns which have central electric lighting stations. The proposed method, in its simplest form, may be described as it might be used in a town which has only one electric arc lighting circuit. At precisely nine o'clock each evening the attendant at the central electric lighting station would open the switch for a moment. All the arc lights on the circuit would blink at the instant of opening the switch. The speed of the electric current is about sixteen thousand miles a second, and the time required by the arc in blinking, or dying down to a red glow, is perhaps only about a quarter of a second after the opening of the switch.

In cities and towns where many electric arc lighting circuits radiate from one central station, the attendant at the electric lighting station might open the switch of circuit No. 1 at nine o'clock in the evening, the switch of circuit No. 2 at fifteen seconds past nine, and so on, until he had momentarily opened the switches of all the circuits radiating from his electric-lighting station. A printed card, in each house, might tell the inmates at exactly what time each arc-lighting circuit would momentarily be opened, and its lights in consequence caused to blink. Instead of printed cards, the local newspapers might contain this information once for all.

Time signals might also be transmitted in a similar manner on incandescent lighting circuits connected with central electric-lighting stations. Where the houses are fitted with incandescent lamps, on circuits connected with central stations, the convenience of incandescent electric lights as time signals would be even greater than that obtainable by arc lights.

In large stores and factories, it might even be advisable for the attendant at the dynamo to transmit a time signal throughout the establishment, at a certain hour each evening. All the employes would thus be enabled to secure the correct time while engaged in their regular vocations. The method might be used in order to distribute time signals on railway trains and ships. All the incandescent lamps might be caused to blink at a certain hour. Hence all the passengers might receive the correct time. The attendant at either a central station or a local plant might secure the correct time for transmission in one of several ways:

1. He might carry a well-regulated watch which could be compared with the government daily telegraphic time signal. 2. A telephonic time signal might be sent to him from some establishment in which a good regulator is already installed, and which is compared daily with the government telegraphic time signal. 3. An electric bell might be placed near the switches, and might be in a circuit connected with an establishment which contains a good regulator. A person in such an establishment might transmit a time signal to the attendant at the central station, shortly before nine o'clock each night. 4. A clock, synchronized hourly by one of the telegraph companies, might be set up near the switches, in the central electric lighting station.

If possible it would be well to have all the switches momentarily opened at nine o'clock, or other suitable time. But this would require an attendant at each switch; hence it would be impracticable. Perhaps inventors can devise a form of compound switch, supplementary to the ordinary switches, whereby one attendant might cause all the electric lights in all the circuits connected with one station to blink simultaneously.

The residents of a city using such time signals as I have herein proposed, would not only be enabled to secure the correct time daily, but also they would be enabled to regulate their clocks and watches with a high degree of accuracy and precision. The user of a watch, on leaving the city for a time, would be enabled to place more reliance upon his time-keeper.

In conclusion, it may be pointed out that one or more arc lamps can be seen from nearly every house in a city, even during heavy rain and snow storms. Hence, nearly all the inhabitants might receive the correct time each evening, without leaving their houses; and, where electric lamps are used in the house, the inmates need not even look out of the window in order to receive the time signal. Moreover, the system, in its simple form, need not cause the outlay of a single dollar. JAMES ASHER.

253 Hickory Street, Buffalo, N. Y., February 12, 1906.

LIGHT POWER BOATS AT THE SPORTSMEN'S SHOW.

The most noteworthy development at the 1906 Sportsmen's Show, now being held in Madison Square Garden, is the application of the gasoline motor to all kinds of light craft for the purpose of propulsion. So far-reaching is this, that it extends even to St. Lawrence skiffs and to canoes. A portable apparatus that may be attached to any small boat in a few minutes, and which will be found illustrated on page 189, forms a further novel method of applying a motor to a light boat.

Among the various light launches exhibited, those built of steel are rather prominent on account of several unquestionable advantages—lightness, water-tightness, and the fact that they are non-sinkable—to be had from this form of construction. Two forms of small 16-foot launches of this type are shown on page 193. One of these is constructed of steel strips fastened together and to the framework by concealed galvanized steel rivets. As these rivets are not exposed to the weather, it is claimed that they can by no possibility rust and cause the boat to spring leaks. Another form is the smooth-skinned, pressed-steel boat, which is made of plates of steel pressed to the proper shape in powerful drop presses. The Michigan Steel Boat Company's craft is an example of the former, and the Mullins Company's boats of the latter construction.

The Michigan boat, as can readily be seen, is a very neat clinker-built launch 16 feet in length. It is fitted with an extremely simple, 1½-horse-power, two-cycle engine. This engine has a water-jacketed exhaust pipe, and a long spark-shifting lever with switch for cutting the current. This switch may readily be opened by pressing a button with the thumb as the hand grasps the lever. If the lever is moved to the other side of the center, and the switch released after the motor has been allowed to slow down, it will instantly reverse. An insulated, spring-pressed, brass block at the base of the lever presses against a fiber cam on the crankshaft, and when it rubs over a brass segment in the cam, the contact is made for the primary circuit, and sparks jump at the points of the spark plug in the top of the motor cylinder. The long, spark-shifting lever makes it possible to adjust the spark to a nicety, as a considerable movement of the top corresponds to a very slight advance or retardation of the time of contact. The crankshaft of the motor is made hollow, and the crank is lubricated by grease forced through from a grease cup at its forward end. Other grease cups lubricate the main bearings. The 2-horse-power motor has a 4¼-inch bore by 4½-inch stroke, and develops its power at about 500 R. P. M.

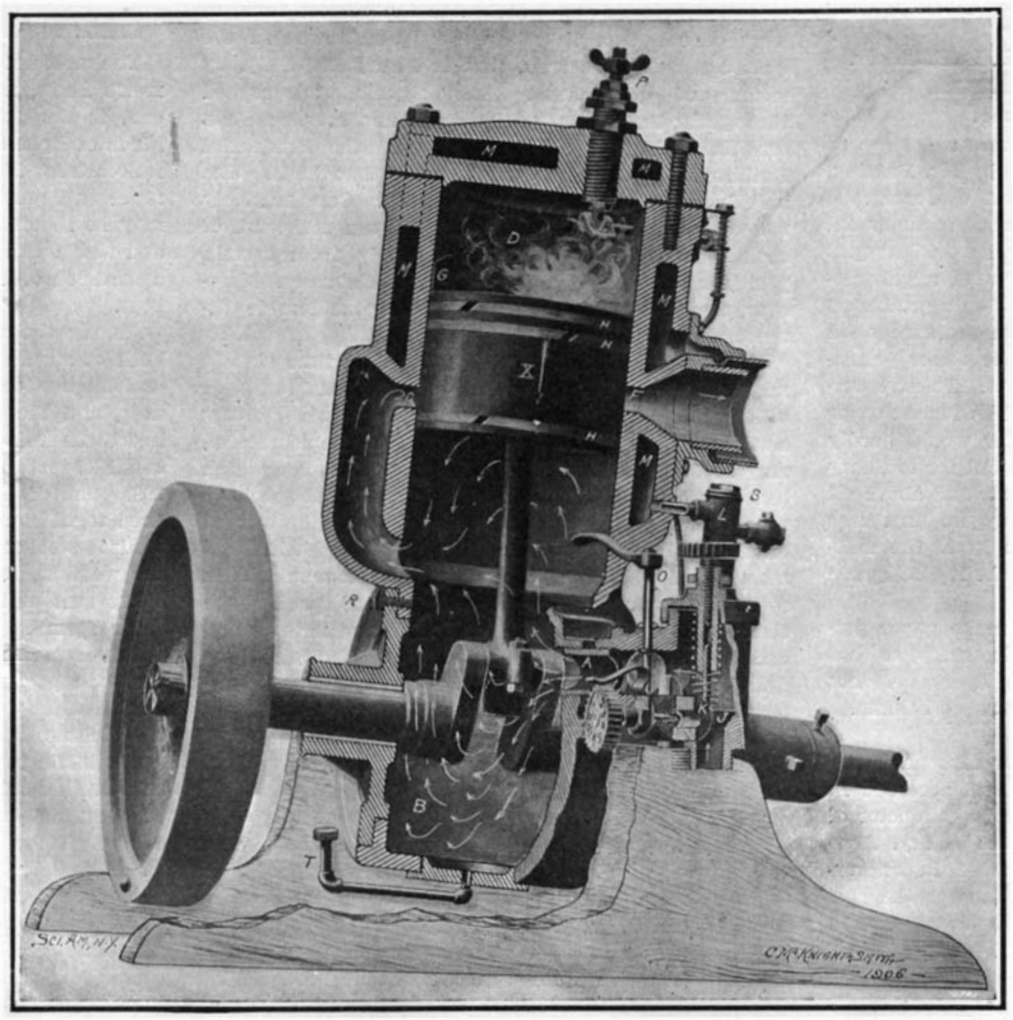
A considerable number of different types of boats are made by this concern. Among these are a small combination power, row, and sail boat; aluminium and steel canoes and ducking boats; a sectional steel boat made in two halves, one of which will fit inside the other; and a flat-bottom boat which may be folded and formed into a trunk.

In order to obtain a smooth-skinned steel boat, pressed steel plates, which have been galvanized and put through a special process that prevents scaling or cracking of the galvanized surface, are fitted snugly over the wooden framework of the hull. The joints of these plates are countersunk and riveted in a similar manner to the plates of an ocean steamer. They are afterward soldered and tested. The hull is consequently one piece of smooth steel, and is guaranteed against leakage at its joints. The keel is not bolted to the outside of the steel hull, but is inside the boat, being placed in a slot pressed into the steel shell for this purpose. It is thus protected, and adds great stiffness to the hull. The steel shell has a slight movement on the framework of the boat, and as the engine is mounted upon the framework, any vibration which the latter receives is not transmitted to the hull, and, consequently, does not tend to loosen its joints. The engine, which is placed in the center of the boat, has an exhaust pipe leading to a tube surrounding the propeller shaft and communicating with the water below the stern. The exhaust gases and cooling water pass through this tube into the water, thus doing away with all odor and noise. This under-water exhaust also has a tendency to keep the stern bearings lubricated.

In both these types of steel boats large air chambers are placed at the front and rear. These are sufficient to keep the boats afloat, even should they become filled with water. As they are built of steel, there is no danger of their destruction from fire. These qualities, together with their durability, make them ideal craft for pleasure or business purposes.

A TYPICAL TWO-CYCLE MARINE MOTOR.

The cross-sectional cut shown herewith gives a very good idea of the interior construction of a Lozier marine two-cycle engine. This engine may be taken as a typical example of the two-cycle type. The piston, *X* (which is fitted with rings, *HHH*), is shown moving downward on the power stroke, being propelled by the burning gases in the cylinder, *D*. The movable electrode, *E*, of the igniter is shown separated from the insulated pin, *P*, which it touched and quickly snapped away from when the piston was at the top of the stroke. Upon the breaking of the circuit a spark was produced, and this exploded the gases. As soon as the piston uncovers the port, *F*, the burnt gases will blow out through the exhaust pipe (which is water-jacketed) by means of their own pressure. A moment later, when at the end of its downward stroke, the piston uncovers the inlet port, *C*, whereupon the compressed charge in the crankcase, *B*, will expand into the cylinder, *D*, being directed upward by the deflector plate, *G*. The piston will then move upward, and compress this fresh charge. At the same time it will produce suction in the pipe, *A*, and will raise the valve, *J*, thus allowing gasoline entering through the pipe, *K*, to flow past the needle valve (which terminates in the seat of valve, *J*), and be drawn through the intervening passages and pipe, *A*, into the crankcase, where it is compressed on the next downward stroke of the piston. An adjustable screw regulates the lift of the valve, *J*, and the needle valve can also be set for the proper amount of fuel. At the base of the rod, *O*, is a butterfly throttle valve used for throttling the mixture. The mechanism which operates the igniter is seen on the right of the motor cylinder. The pump, *L*, draws in water through the check valve, *S*, and circulates it through the water jackets, *M*. This pump is operated by an eccentric. The pipe, *T*, is used for introducing a certain amount of oil into the crankcase. This serves to lubricate the crank and wristpin by means of the splash. The main crankshaft bearings are lubricated by grease cups. The above description will give the novice some idea of the construction of the two-cycle motor.



CROSS-SECTION OF TYPICAL TWO-CYCLE MARINE MOTOR.

ELECTRIC LAUNCH WITH RECHARGING EQUIPMENT.

An improvement in electric launches, whereby they are made independent of an outside source of current for recharging the batteries, has been brought out by the Electric Launch Company on their 1906 pleasure craft. This consists of a horizontal double-opposed-cylinder motor placed just in front of the electric motor and adapted so as to be connected with it by a jaw clutch when, at the end of the run, it is desired to recharge the battery. The gasoline motor has a portable fuel tank, which may be filled, placed outside the boat, and connected to the carbureter through a flexible pipe when it is desired to recharge the batteries. This can be accomplished in three or four hours. Both motors are placed at the rear of the boat under the floor, which is raised some inches above the main floor at this point. The batteries are placed in the bottom of the boat forward of the motors. In case of emergency, or if more speed is wanted, the gasoline motor can be run in conjunction with the electric motor provided gasoline is carried on board. It is always started by the electric motor, and no cranking is necessary. Jaw clutches are provided between the motors and between the electric motor and the propeller shaft. The arrangement is an ideal one, as it makes possible the use of the silent electric launch under all conditions; while, with the battery charged, there is never any doubt about starting and taking a sail when one wishes. Ladies or children can operate these boats as readily as can men. For recharging *in situ* gasoline motors of from 4 to 10 horse-power are fitted according to the size of the launch. These boats range in speed from 7 to 9 miles an hour under electric propulsion, and from 10 to 12 with the motors combined. They have a radius on a charge of 50, 65, or 90 miles according to the size of the battery installed. Forty 150 ampere-hour cells is the smallest battery used. The 8-horse-power electric motor develops normally about 5 horse-power and consumes 30 amperes of current for the 7-miles-an-hour speed.

THE NEW "SPEEDWAY" MARINE ENGINE.

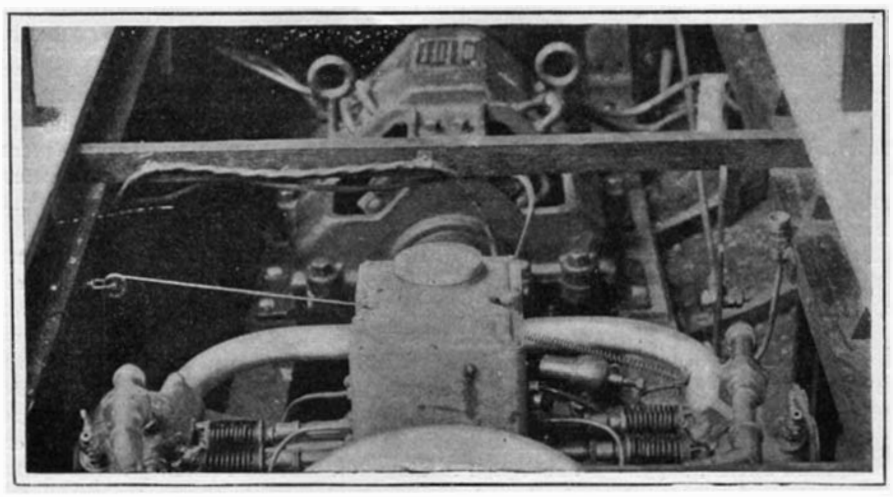
One of our illustrations represents a four-cylinder "Speedway" gasoline engine of 6-inch cylinder bore by 6-inch stroke, capable of developing 40 horse-power at 850 revolutions per minute.

These engines, of the type shown in cut, work on the four-cycle principle, and are designed with a reversing clutch for marine use. The engine shown is adapted for use in either pleasure cruisers or working boats. A lighter stanchion engine is built for high-speed motor boats. The sizes of these four-cycle motors range from 8 to 150 horse-power, the number of cylinders being ordinarily four and six.

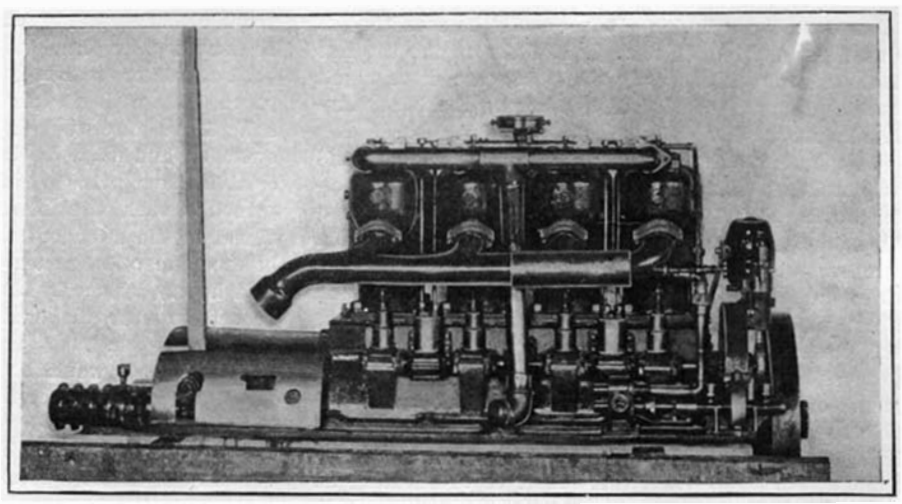
The cut represents the standard type, with cast-iron base and frame in two separate parts. The camshaft is on the outside of the frame, thus making it possible to take this shaft out easily without dismantling the engine. The cylinders are cast separately, with a pocket on one side for the exhaust valve, which is operated by a direct lift from the cam. The inlet valve is located directly over the exhaust, and is opened by a downward push, which is obtained by a reciprocating rod operated by the inlet cam. The rod passing up one side of the cylinder pushes on one end of a lever bracketed on top of the cylinder, the other end of which lever opens the valve. The relative position of the exhaust and inlet valves is advantageous, as the cool, incoming gas is obliged to pass over the hot exhaust valve, thus helping to keep it cool and lengthening its life, by preventing the distortion and deterioration which so often take place from overheating this valve. The pistons and connecting rods of these engines are made as light as is consistent with good practice, thus permitting high piston speed with minimum vibration. All bearings are of ample size, to insure long service and an absence of excessive heating. The valves can be removed and reground with the removal of but a few simple parts. The problem of oil tightness has been satisfactorily solved, as the engine is practically oil tight. No leaky joints are to be found, as is so often the case where screw connections are used in the water pipes. The engines are also designed to be pleasing to the eye, with well-rounded cylinders, polished cast-bronze water pipes, inlet pipes, and inlet valve covers. The engines are not designed on the lines of an automobile engine, but according to safe mechanical construction, which would be acceptable in any stationary engine intended to run for long periods without stopping. The accessibility of all important parts of the engine—a feature so often overlooked in gas engine design—has also been carefully worked out. Throughout the best material is used, such as nickel-steel crankshafts and exhaust valves, prosphor-bronze bushings in the upper end on connecting rods, and in other places where bronze bearings are used. The engine parts are made to jigs as far as possible, thus making it easy to replace parts quickly and satisfactorily. Ball-bearing thrusts are used, and these are carefully protected from water. The larger sizes of these engines are designed to be started by compressed air Several sizes of two-cycle "Speedway" motors are also built by this company, embodying all the up-to-date devices.

The reversing clutch used with four-cycle engines is of the planetary type. All cut spur gears are of steel of the finest material and used extensively. The friction clutch is of special design and of more than usual power. It is easily manipulated, and so constructed that the wear is very slight. Adjustment is simple and quickly made. For high-speed boats, where the utmost power possible is required to be developed by the engine, a clutch that is absolutely positive is used, friction not being depended upon to rotate the shaft. This arrangement embodies an entirely novel design brought out by this company during the fall of 1905, a patent for which has been applied for. It is so constructed that no matter how much power is applied, it cannot slip in any manner.

The manufacturers' special claims for these engines are: Up-to-date design, superior material and workmanship, and a resultant reliability, high efficiency, and durability.



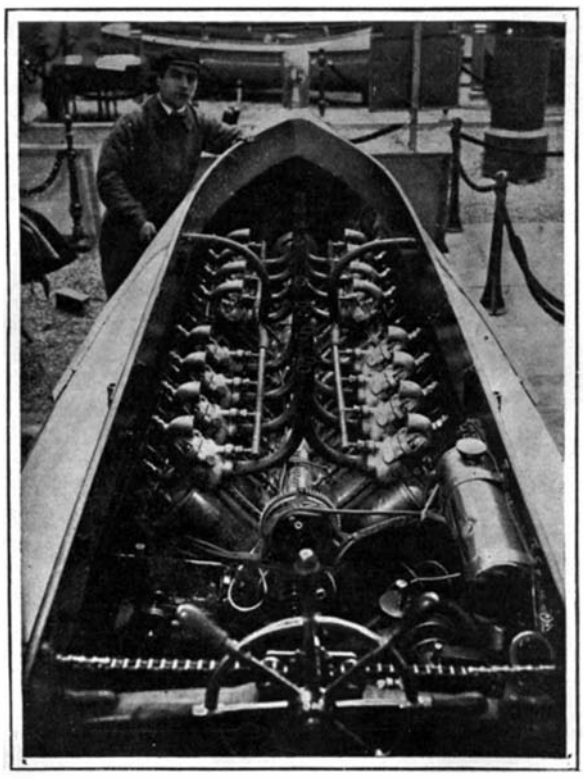
GASOLINE MOTOR DIRECT-CONNECTED TO ELECTRIC MOTOR FOR RECHARGING THE BATTERIES OF AN ELECTRIC LAUNCH.



40 H. P. MARINE MOTOR WITH CLUTCH AND REVERSE DRUM. THE IGNITION DYNAMO IS PLACED ON END ABOVE THE FLYWHEEL.

A SIXTEEN-CYLINDER MOTOR-BOAT ENGINE OF 180 HORSE-POWER.

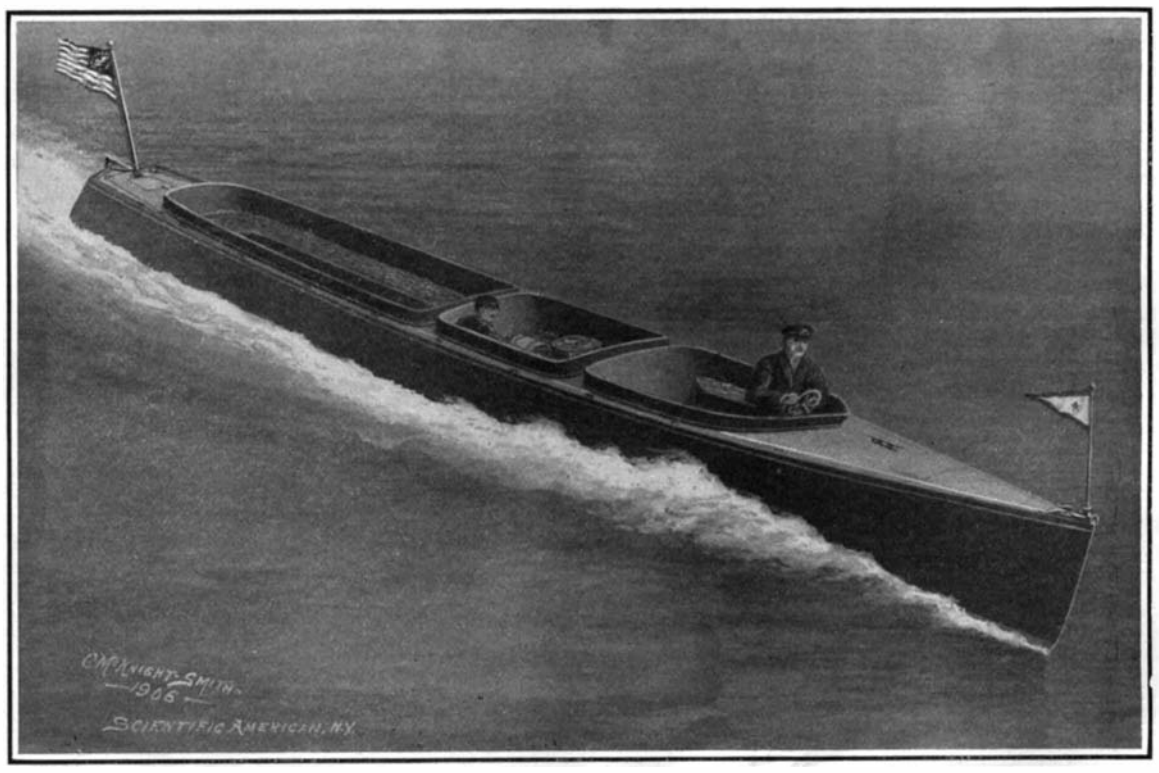
The new 8-cylinder gasoline motor which has been brought out at Paris by M. Levavasseur, has a number of novel features. Our illustration shows two 90-horse-power motors as mounted in tandem on the launch "Antoinette," one of the prize winners of the season. By the use of eight cylinders great steadiness of power is secured as an impulse is obtained every one quarter of a revolution, and hence the flywheel can be dispensed with. Another great advantage lies in the fact that the motor can be run in either direction by the placing of special cams upon the cam shaft. By pulling a small handle located at the end of the cam shaft, the cams are shifted and the motor is reversed. The constructors claim that the new motor thus has the advantages of a steam engine.



TWO 90-HORSE-POWER, 8-CYLINDER MOTORS CONNECTED IN TANDEM IN THE RACER "ANTOINETTE III."

The carburetion is produced by a small gasoline pump worked from the motor. It draws gasoline from the tank and sends it to eight small distributors placed at the top of each motor on the inlet. These regulate the supply of liquid, causing the spray action which is needed. The output of the pump is variable at will, but its automatic action is preserved, as it is run from the motor. Good carburetion is always secured in this way, and the method has an advantage in suppressing a large amount of piping.

The new "Antoinette" motor consists of eight cylinders mounted four on each side and at an angle of 45 degrees upon a crank case, as will be noticed. The eight cranks work on a single shaft. A cam shaft works the eight exhaust valves. What is to be remarked about the new motor is its great lightness in proportion to the power it will give. The 90 to 100 horse-power motor, having a 5.2-inch bore and stroke, weighs but 330 pounds, not including the reversing mechanism and ignition devices. With the latter, the weight is 370 pounds. It measures only 32 inches long and somewhat less in height. The great advantage of the motor when applied to a launch lies in the fact that it can be used to operate the propeller directly without needing a friction clutch or a reversing mechanism. It also starts up as soon as the ignition is set working, seeing that two of the cylinders are always in action. The new motor is claimed to be the lightest per horse-power that has yet been produced, this figure being 3.3 pounds per horse-power, and it is thus specially adapted for use upon airships. The smallest motor which has been constructed is a 40-horse-power size, while the largest size gives 400 horse-power. With the two 90-100 horse-power motors the launch "Antoinette III." made a remarkable performance lately at the Monaco races, where it took one of the prizes.

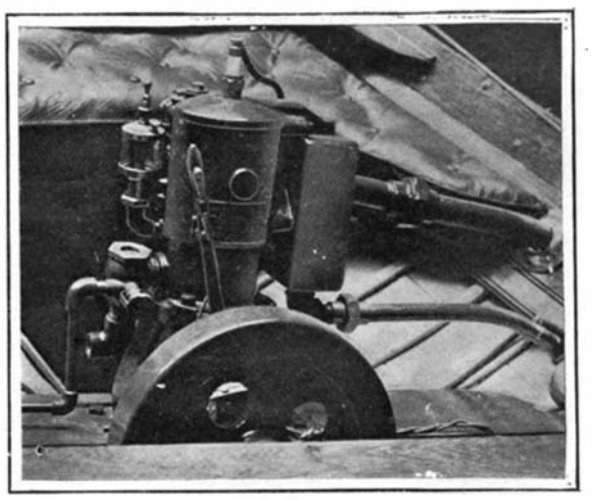


A NEW TWIN-SCREW SERVICE BOAT FITTED WITH TWO SEPARATE POWER PLANTS OF 30 HORSE-POWER EACH. THIS BOAT IS INTENDED FOR USE ON LAKES AND RIVERS

A SERVICEABLE TWIN-SCREW MOTOR BOAT.

BY THOMAS J. FAY, E.E.

Twin-screw motor boats, if not altogether new, are quite rare, to say the least. This is not because the principle of twin-screw propulsion is in any way in question, but because motor-boat work did not grow up to the level of twin-screw products until very recently.



A SIMPLE 1½-HORSE-POWER, 2-CYCLE LAUNCH MOTOR.

Before dipping into the precise details of the boat to be described, it may not be amiss to state that the question of the use of a duplicate plant in its entirety is one now receiving much attention from designers and users alike, and the trend of motor-boat construction is toward more power, greater safety, and immunity from any serious inconvenience in the event of a mishap to any of the equipment.

At first it was thought the best way to obtain more power was to put two motors in "tandem." A few attempts at this arrangement put an end to it entirely, except in cases, like the "Dixie" and the "Challenger," involving the design and construction of eight-cylinder motors with integral bases and especially designed crankshafts, as well as an arrangement of accessories to match.

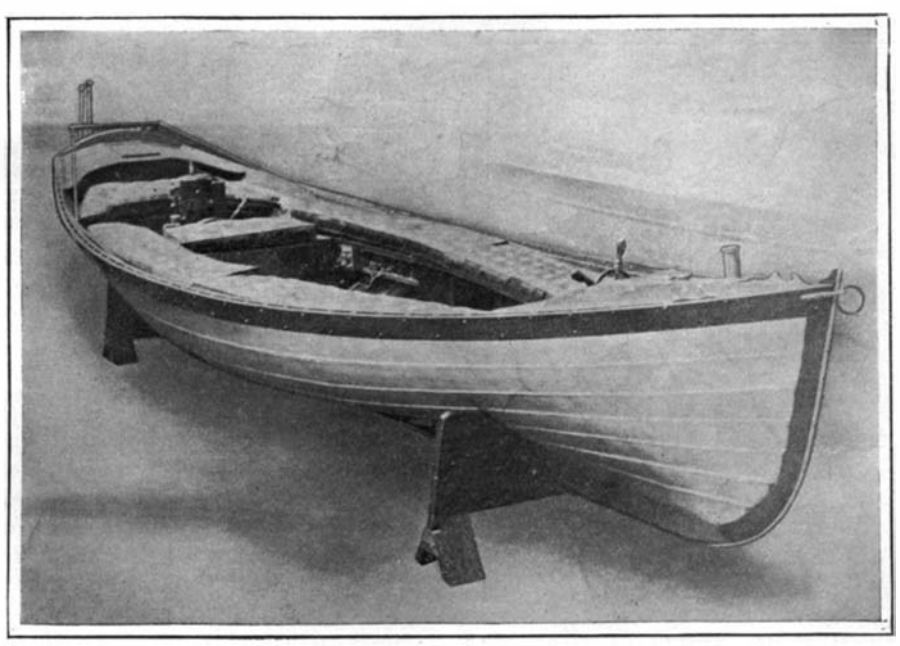
This, however, is altogether different from putting two motors in tandem and coupling their crankshafts together; for, as anyone can see, the crankshaft, barely large enough to sustain the power impulses of its own four cylinders, would be practically useless after sustaining the extra effort of four more cylinders for even a short while.

The best way, without any doubt, to realize the fullest benefit from the use of eight cylinders is to employ two motors in such a way as to afford two complete and independent power plants, even to the extent of employing two separate and distinct fuel tanks, and of course two screws, not to mention the attending accessories.

It is the purpose here within the brief space afforded to point out the most conspicuous features of one of the latest creations in the Simplex series. The main dimensions of this twin-screw boat are as follows:

HULL DIMENSIONS.—Extreme length, 45 feet; Load-water length, 44 feet; extreme beam, 6 feet 6 inches; water line beam, 6 feet; draft, 10 inches; propeller draft, 2 feet 5 inches; approximate speed, 20 miles per hour.

MOTOR DIMENSIONS.—Number of motors, 2; rated horse-power of each, 30; total rated horse-power, 60;



LIGHT, CHEAP, AND SERVICEABLE STEEL LAUNCHES FITTED WITH AIR TANKS WHICH MAKE THEM UNSINKABLE.

number of cylinders, 4 per motor; bore of cylinders, 4½ inches; stroke of piston, 5½ inches; type of motor four cycle; rated speed of crankshaft, 800 to 1,000 R. P. M.; fuel tank capacity, 60 gallons; fuel radius, 150 miles.

The first essential and important difference between this equipment and the conventional motor-boat installation, lies in the fact that the machinery equipment in its entirety is a separate self-contained unit, or, in this case, double unit in fact. The machinery complete is in no way dependent upon the hull for even its supports, for the entire equipment is first set up on its own independent girders in the shop, and upon its completion and test is lowered into the hull as a unit ready to run.

The old method of hanging the magneto to the skin on the starboard side and the carbureter to the ribs on the port side, or suspending the oil piping from the sheer-strake and hiding the battery in the fore peak where no one would be able to find it, is not adhered to in the least in this new system of construction. As just stated, the machinery in this case is absolutely separate and distinct from the hull in every way. It was found, in fact, that men accustomed to hull work were not efficient around machinery, and it has been the invariable custom with the present constructors to keep the respective classes of work separate, even to utilizing separate buildings remote from each other, the one for motors and the other for boats.

The appearance and general arrangement of the new twin-screw boat is made apparent from our illustration. As can be readily seen, the engines are very compactly placed in a cockpit at the center. The spark coils and control levers are on panels just back of the motors, where they are very accessible.

The sparking equipment consists of both a magneto and a storage battery, either one of which may be used at will. The timing of the spark is properly fixed by means of the Simplex jump spark timer.

The carburetion is taken care of by a governor-controlled Mercedes type of carbureter. There are important differences, however, between the Simplex carbureter and the Mercedes type it represents. As a matter of fact, the mixture provided to the motor through this carbureter is always rich enough to assure prompt starting, and is adjusted thereafter automatically to afford the right air dilution for all speeds.

The governor is of the "flyball" type on the camshaft, and is connected up by straight-line levers, while the oil pipes and other parts are neatly and securely fixed to the motor.

Among the novelties of construction may be noted an improved sea cock, by means of which the water for cooling is taken through the skin of the hull aided by a scoop, and screened before it reaches the gear circulating pump. This sea cock has a rubber ball which acts as a check valve and as a positive valve as well, and it is one of the nice fittings especially developed for motor-boat work, which differs in important details from the work done in hulls prior to the advent of motor boats of the higher order.

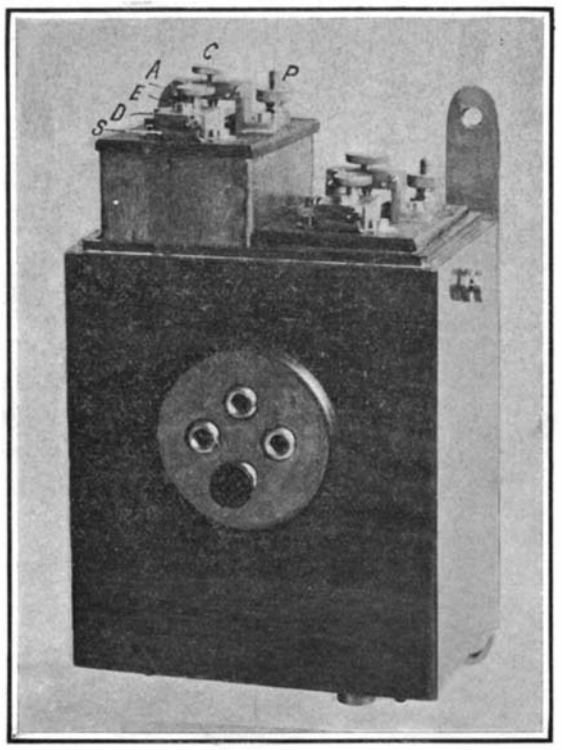
The gasoline tanks are protected by surrounding them with a copper jacket, and thus keeping them submerged in sea water. The fittings are so arranged as to afford entire immunity from accidents as a result of a leaky joint if, perchance, such a contingency should arise. At the same time, one may examine every joint in a moment at will, without even shutting down the plant. Moreover, leaks are highly improbable, because the scheme of piping is so thoroughly worked out as to eliminate such occurrences excepting as a rare contingency.

In the construction of the hull, Parsons manganese bronze castings are used, to the exclusion of composition or other cheaper brass products. The framing of the hull, while light, is of the finest white oak, while the planking is of Mexican mahogany and British Columbia cedar. Natural knees take the place of jointed members where knees are used, and copper fastenings are used throughout. The cutwater is of bronze finished to a knife edge, while the propellers of three blades each, as well as the rudder quadrant and other similar devices, are all of a special design of the same high-grade bronze.

This boat has a large seating capacity, possesses great stability, and is intended for family use on one of our inland lakes. The internal arrangements include every requisite for comfort, with ample storage under seats, while a canopy top will enable the owner to use the boat in fine and inclement weather alike. For the accommodation of ladies, the after end of the after pit may be curtained off; but all super work may be removed at will to accommodate a large fishing party on a fine day.

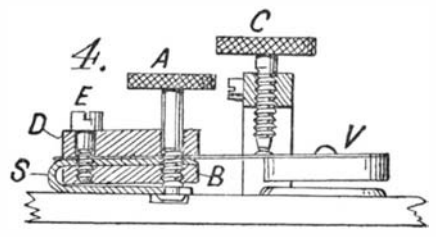
IMPROVEMENTS IN SPARK COIL CONSTRUCTION.

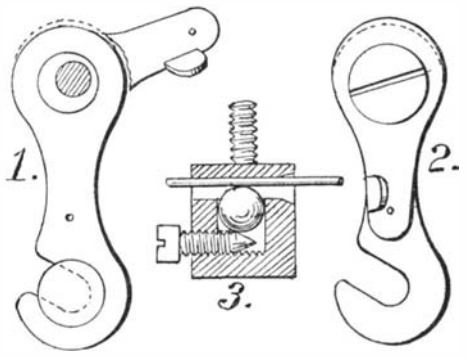
The spark coil depicted in the accompanying engravings embodies a number of interesting constructional features. The coils are made up in sets of two, three, or four, according to the number of cylinders of the engine, and are compactly stowed in a single case. The cover of the case is locked in place by means of



AN IMPROVED SPARK COIL.

the hooks which are shown in Figs. 1 and 2. These, it will be observed, are mounted eccentrically on the hubs of a pair of thumb levers, which may be operated to lift the hooks, as in Fig. 2, thus causing them to tighten their hold on the pins. When it is desired to remove a coil, only the primary terminal, *P*, need be unfastened, as the other connections are made by means





DETAILS OF THE SPARK COIL.

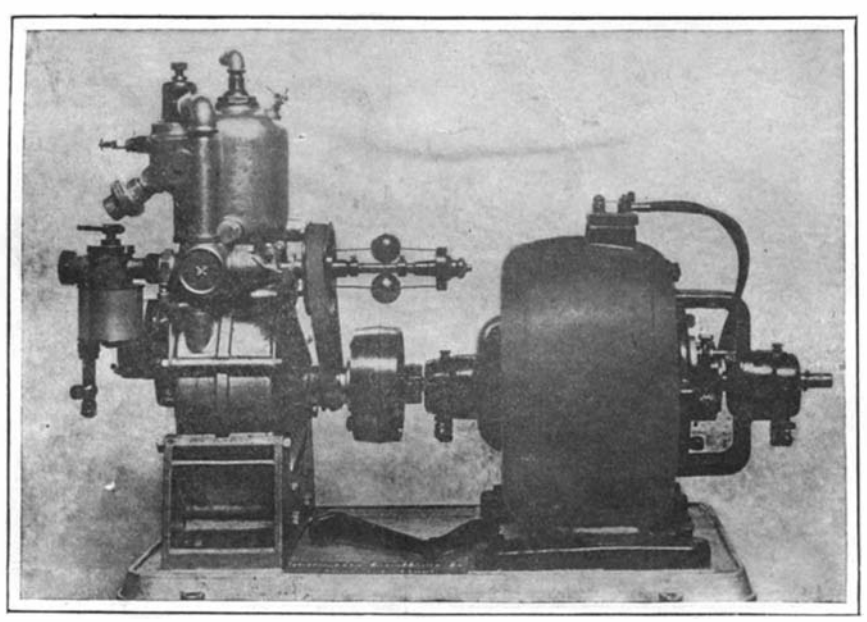
of contact plates at the bottom of the casing. The secondary terminal wire, which passes down inside of the coil, makes connection with a binding post at the bottom of the casing. This post differs from the ordinary type. Instead of binding the wire by screwing a setscrew against it, the setscrew is fed against a ball which bears against the wire, as shown in section in Fig. 3. This insures a good contact, and prevents injury to the wire. An important feature of the coil is the novel construction of the interrupter, which is clearly indicated in Fig. 4. The spring of the vibrator, *V*, is held between the block, *D*, and the heavy spring plate, *S*, which are clamped together by means of a screw, *E*, threaded into the plate, *B*. The thumbscrew *A* provides for the adjustment of the vibrator toward and from the core of the coil. The thumbscrew is threaded through the plate *B*, and is formed at its lower end with a groove adapted to engage a slot in the lower portion of the spring plate, *S*, which is secured to the coil head. Since the lower portion of the plate, *S*, is fixed, it follows that when the screw, *A*, is turned in one direction, it will move the block, *D*, down, carrying the vibrator toward the core, and when turned in the other direction it will positively lift the vibrator from the core, regardless of the spring tension of the plate, *S*. It is customary in other constructions to depend on a spring for the adjustment in one direction, but the spring is apt to become weakened in time, and for this reason the positive adjustment in both directions is provided in the present construction. The thumbscrew, *A*, passes through a split bearing in the block, *D*, and a setscrew is provided for tightening this bearing onto the body of the thumb-screw when the proper adjustment has been secured. By loosening the screw, *E*, the vibrator is released and may be withdrawn, as the vibrator spring is slotted to clear the body of this screw and that of the thumbscrew, *A*. The contact screw, *C*, is threaded into a split yoke-frame, which may be closed onto the screw to hold it at the desired adjustment.

Elastic Supports for Machines.

In a recent conference at the Sorbonne, M. Anthoni gave an account of the means which were used to do away with shocks, noise, and vibration, and showed the advantages and disadvantages of different kinds of compressible and non-compressible materials for this purpose. The first class, such as cork, carpet, felt, fur, etc., have the disadvantage of a lack of homogeneity and lack of constant properties, since they are resilient and work by the flexion of their particles, thus breaking down gradually. The second class, the incompressible materials, he divides into non-plastic matter such as sand and asphalt, and the plastic and elastic materials like rubber. To allow a machine to run without noise or shocks he devised a new elastic support which is portable. It is formed of two concentric cubes, the inner one being heavy and firmly fixed to the ground, and the outer one being hollow and attached to the machine. The two cubes are separated by six washers bearing on the cube faces, tending to compress the inner cube and press out the faces of the outer cube. The lower face of the large cube is formed of a steel disk. From it a bolt passes through the inner cube without touching it. The base which connects the inner cube to the ground passes between the steel disk and the vertical faces of the large cube which carry brace-pieces allowing the washers to be tightened. In this way he mounted two engine and dynamo groups of 125 and 60 horse-power with Willans engines running at 500 revolutions. No noise or other trouble was found in this case.

VIBRATIONLESS ELECTRIC LIGHT SETS FOR YACHTS.

One of the interesting exhibits at the National Motor Boat and Sportsmen's Show is a vibrationless direct-connected electric light set, which we illustrate herewith. These sets are made up with genuine imported De Dion engines direct-connected to generators especially built for the purpose. The engines are throttle governed and the whole equipment is thoroughly up-to-date. They are the most compact, light-weight sets on the market for their output, and are provided with a special vibrationless support which allows them to be used for launch and yacht work. By means of this special coiled spring suspension, every particle of vibration and a large part of the noise is eliminated, so that the sets are exhibited in operation, placed on a light box without being fastened down. The engines run at moderate speed, and are of an especially durable type, well known to the automobile public for their reliability, endurance, and steady running. These sets will produce perfectly steady light, there being no flickering whatsoever. A special type of ball throttle governor is used for controlling the speed, and the ignition is jump spark. These sets are wound for various voltages depending upon their use—for storage battery charging, house lighting, and launch and yacht lighting. They have proven very popular, quite a number having been installed up to the present. One of these sets is shown in operation in the basement of Madison Square Garden at the present show.



DIRECT-CONNECTED ELECTRIC-CURRENT GENERATING SET FOR STATIONARY OR MARINE USE.

ARTIFICIAL SEA BATHS.

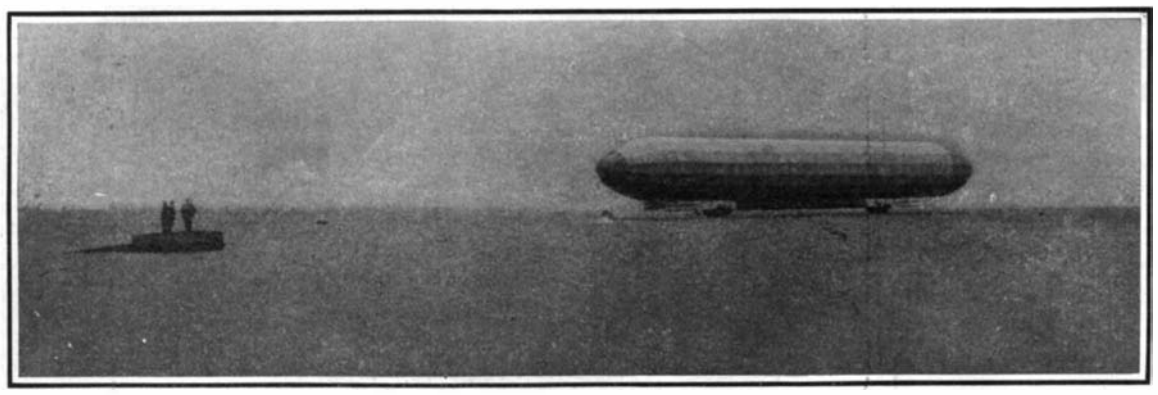
BY DR. ALFRED GRADENWITZ.

A decided novelty for inland summer resorts is provided by the artificial surf bath which is herewith illustrated. The scheme is the invention of Herr Höglauer, of Munich, Germany. With the assistance of Herr H. Recknagel, a plant was installed in the Starnberg lake near Munich, last summer, and proved to be a great success, yielding very satisfactory financial results. The project calls for a tank of water, or the inclosure of a portion of the lake or river in which it is installed, as shown in the photographs. At the outer end of the inclosure is the wave-forming machinery which comprises either an oscillating partition or a plunger dropped periodically into the water. In this way the waves are formed and they travel the length of the tank. The tank is provided with a sloping bottom so that the receding waters from one wave, meeting the succeeding wave, will cause the latter to curl and break in perfect imitation of the ocean surf. If the device is installed in a tank, it is possible to exactly reproduce the conditions of ocean bathing by adding salt to the water and thus preserving the hygienic and therapeutic properties of the ocean bath. The power necessary to produce the waves is very small, as the motion is rhythmic. For example, in the case of waves measuring 2 meters (6.5 feet) from crest to crest, the best results are secured with a rate of 18 waves per minute, when the expenditure of energy will be 4 horse-power for a tank 1 meter (3.3 feet) in breadth. If steam power be used, the exhaust steam of the engine may be utilized for heating the water. Thus the temperature of a bath may be regulated to the desired degree and by the proper control of the engine the roughness of the waves may also be regulated so as to make the bath an ideal one. The inventor has also designed a small device for use in tubs, whereby the tub is rocked to produce the wave effect. The rocking of the tub may be effected either with an electric motor or by means of oars operated by the bather himself.

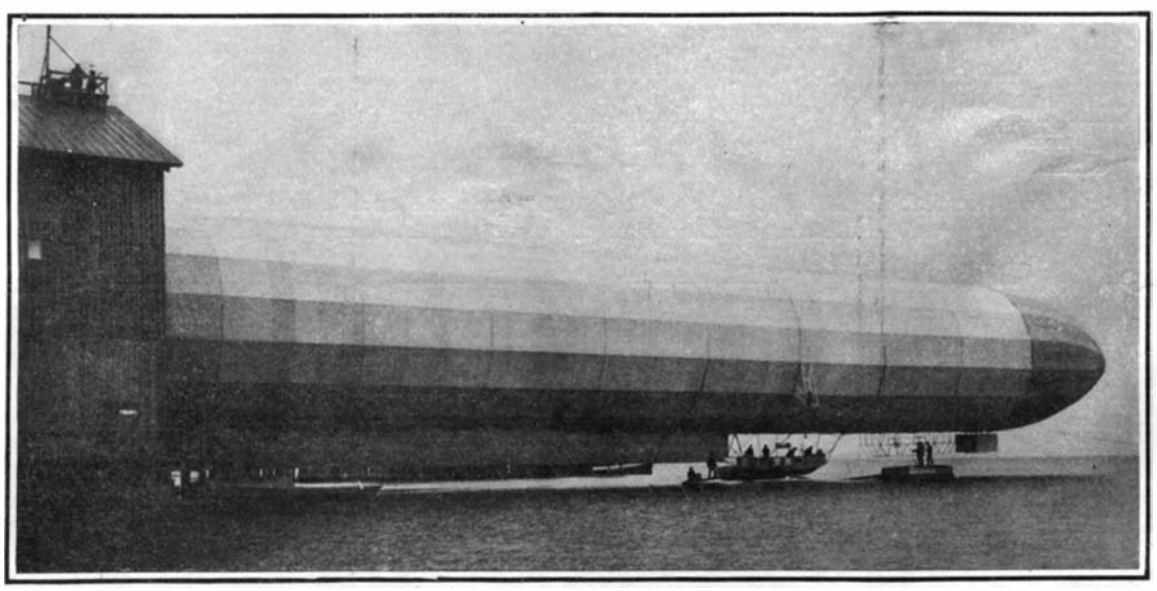
COUNT VON ZEPPELIN'S DIRIGIBLE AIRSHIP.

General Count von Zeppelin has repeated the Bodensee experiments with his dirigible airship, which were concluded in 1900, and undertook an ascension on November 30. For several reasons, in no way involving the principle of construction, it was necessary to desist from this attempt for the present.

For the sake of completeness, it is necessary briefly to recount the results of the experiments of 1900, which at the time were discussed in well-illustrated articles in the SCIENTIFIC AMERICAN. Three flights were accomplished five years ago—on the 2d of July, the 17th and 21st of October. In July the craft demonstrated that it could be steered and propelled against a breeze moving at the rate of about 18 feet a second. At that time the full power of the engines was not utilized, as strong longitudinal oscillations had to be contended with, these being due to the fact that the rear retaining ropes of the airship were released too late. In addition, the crank of the adjustable sliding weight broke, so that it was possible to maintain a state of equilibrium only by running the engines alternately forward and backward. The landing upon the surface of the lake, announced beforehand by means of flag signals, was completely successful.



TRIAL TRIP OF ZEPPELIN'S IMPROVED AIRSHIP.



THE IMPROVED DIRIGIBLE AIRSHIP OF COUNT ZEPPELIN.

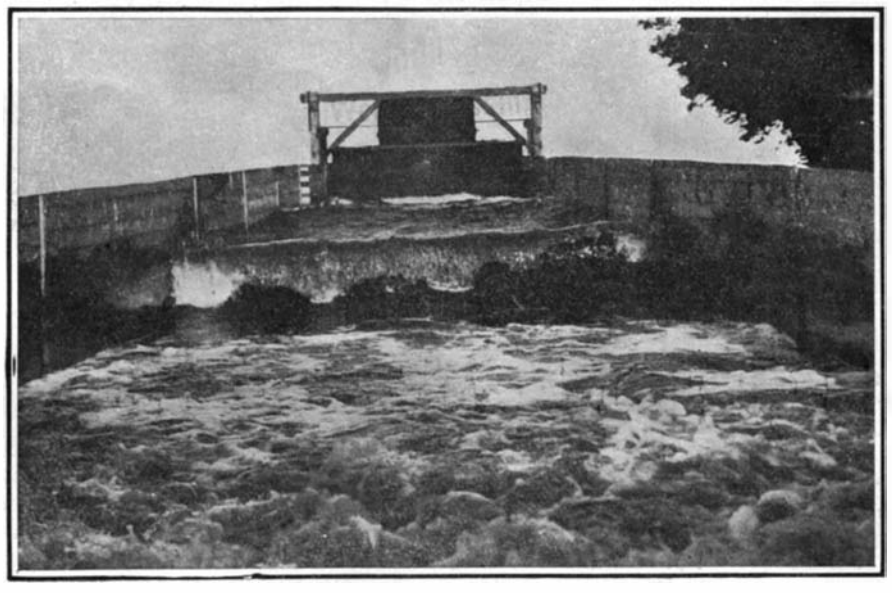
After a number of improvements, complicated through an unfortunate occurrence—the failure of certain fastenings of the framework and the collapse of the middle part—the second trial trip took place. A position of equilibrium was attained successfully at a height of about 300 yards, but the steering-gear caught in the outer portion of the skeleton and was held to port, thus producing a swinging movement. This was counteracted by using the second rudder in opposition to the other; but this time also it was not possible to use full power, as the hour was late and a landing was imperative. This was accomplished sooner than was intended, as a valve in the balloon opened of its own accord, permitting the escape of the gas in a forward compartment. The ship had been in the air for 80 minutes.

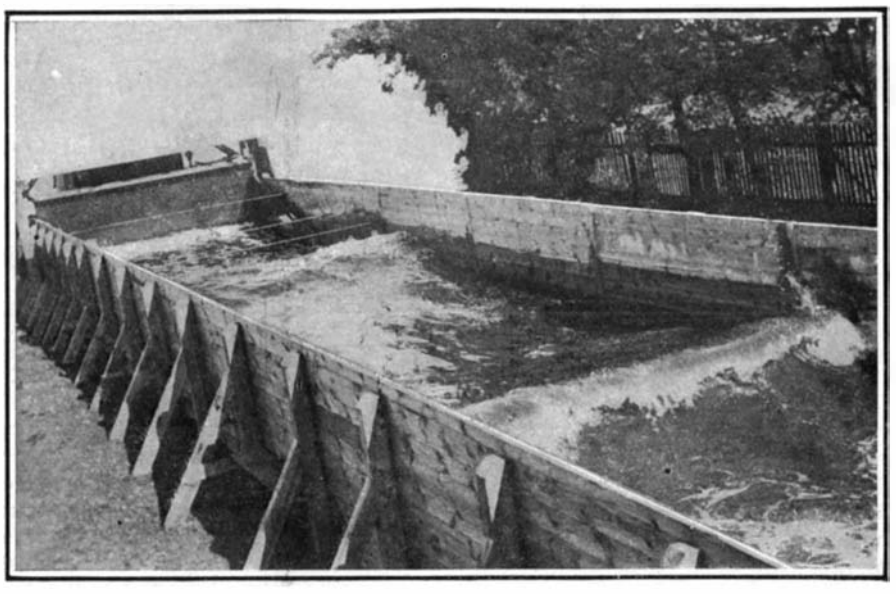
Both defects were soon remedied, and four days later the imposing craft rose into the air for the third time. The dirigibility was excellently demonstrated, this time in fact with two instead of four steering surfaces. Several great arcs were described to right and left. After a flight of 23 minutes a landing was made, again because of the lateness of the hour. As the financial resources of the constructing company were exhausted, further experiments were not possible.

The speed attained by the airship itself was found to be 24.5 feet per second, a rate, nearly 18 miles per hour, never before accomplished. The determination was made by three careful and independent surveyors, stationed at three different points on the shores of the Bodensee. The wind blew at the rate of about 11 feet per second. Taking into consideration the curves of the flight, Prof. Hergesell has calculated the independent speed to have been as high as 28 feet a second. This success was unquestionable.

Following the experience gained in 1900, the motor airship was improved in almost all its details. The greatest advance lies in the increase of the motive power with practically no increase of weight. Each of the engines in the two carriages is now of 85 horse-power, so that to-day 170 horse-power is available instead of 30 as formerly. As this weighs only 11 pounds more than the earlier installation—880 pounds *in toto*—even the layman will recognize that the independent speed of the craft must be far greater. The length of the airship has been decreased by about two yards, the diameter being made somewhat greater. With a length over all of nearly 410 feet, the diameter is a trifle over 38 feet. Instead of seventeen gas compartments, the balloon now contains one less, with a total cubical content of hydrogen gas of about 367,120 feet, some 31,700 cubic feet less than in the former model. The total weight to be lifted is about 19,800 pounds, nearly 2,200 less than in 1900. The propellers have been made somewhat larger.

The two steersmen or guides, aeronautic and aerostatic, were located in the forward car, where also were the wires, arranged visibly upon a board, which led to the valves of the gas chambers and the ballast bags. The latter, made of a waterproof material and filled with liquid, were equally distributed upon the skeleton; part of the ballast was also located upon the cars, and two of the bags are distinctly visible upon one of the accompanying photographs. Benzine, sufficient for a trip lasting 15 to 20 hours, was carried in special tanks in the two cars. In the possibility of long flight duration, the Zeppelin airship possesses a particular advantage which Lebaudy has not yet taken into consideration. This, too, is the reason why Count Zeppelin built his ship of such great size. If it is desired to transport large weights, it is necessary to con-





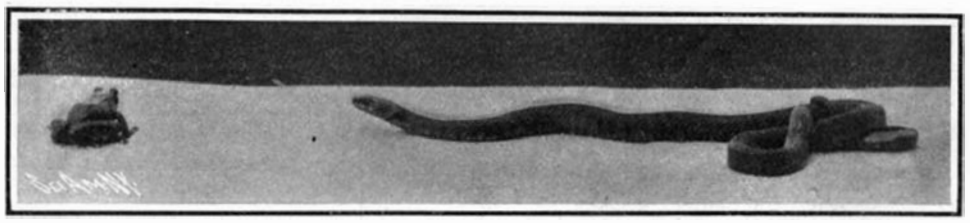
AN APPARATUS FOR PRODUCING ARTIFICIAL SURF BY MEANS OF AN OSCILLATING PARTITION OR A PLUNGER DROPPED PERIODICALLY INTO A TANK OR INCLOSURE CONTAINING WATER.

struct large airships; this is dependent upon the carrying capacity of the gases. Fore and aft there are three vertical linen surfaces for horizontal steering. Between these and the car bodies are horizontal surfaces for vertical steering, the vanes being arranged one above the other as in an aeroplane. The aeronautic guide or steersman controls all rudders from his position.

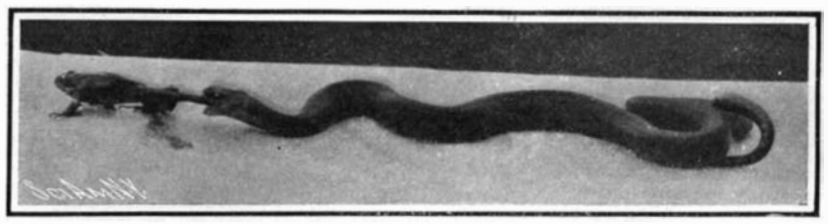
In the test of November 30, it was noticed that the aeronautic steersman of 1900, Von Krogh, was located in the rear car and was replaced, forward, by the engineer of the airship. This change of the guidance in tests of such a difficult nature naturally caused some surprise among the experts, especially as the steersman was able to acquire but little experience in the few ascensions he had undertaken previously in a balloon of the ordinary type. Every aeronaut is familiar with the difficulty in the guidance of a large balloon of even the usual kind, and in a motor airship this difficulty is largely aggravated.

The filling of the gas-bag was accomplished on November 29 in six hours—the first attempt required fourteen, the second seven hours—and on the following day the craft was drawn out from the house, the wind at this time having a velocity of 19.5 feet per second. In the forward car were Count von Zeppelin, Engineer Dürr, and two machinists, and in the after car, Von Krogh, Eugen Wolf (the well-known African traveler, who also participated in the trials of 1900), and two machinists. According to the various newspaper accounts published by Eugen Wolf and the accounts of witnesses upon the balloon house, a steamer, etc., the trial occurred as follows: The running out of the craft from the house presented the first difficulty, for the lake was at a very low level, and the airship could not, as intended, be drawn out upon the lake while resting on a float, but had to be pulled forth directly by means of a tug. The turning against the wind, which blew toward the shore, was not intended to take place until a position farther out in the lake had been attained. But small causes give rise to great effects. The wind drove the airship ahead of the tug, so that it was necessary to drop the towrope. Because of a knot in the latter, it remained attached to the balloon, and this received so strong an impulse at the forward extremity, that the forward steering apparatus entered the water while the after car was still suspended in the air. Furthermore, the forward motor obstinately refused to work, By means of the release of ballast and through the efforts of the second motor, the airship was again sent aloft; but as the forward steering gear had become useless, the trial was soon given up, and the airship returned to the house, where it arrived after the expiration of an hour and a half.

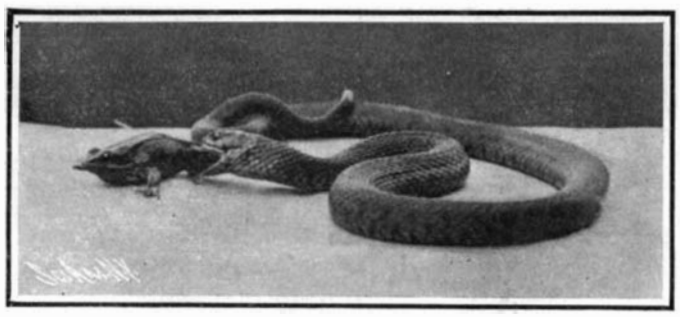
The experiments will soon be renewed. It must be remarked that this trip was undertaken merely as a tentative trial. Count von Zeppelin never intended to immediately travel back and forth over the Bodensee for hours, but all the details were thoroughly to be tested, first in shorter and then in longer flights. Many people expect immediate and successful results from a structure as difficult to control as a dirigible airship, while this is not the case in other new machines. It is to be hoped that we shall soon hear something further about the airship of the energetic Count.



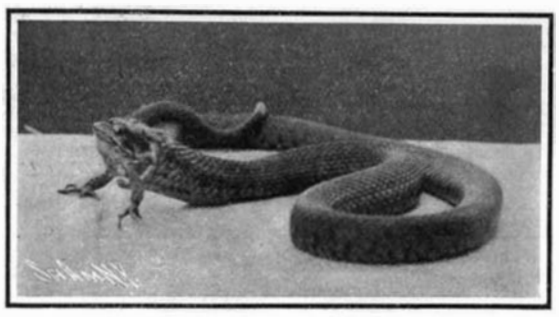
Approaching His Prey.



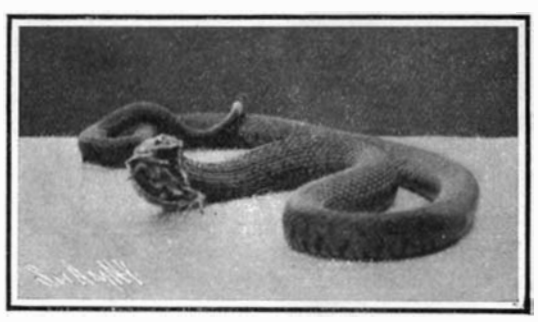
The Prey Captured.



Swallowing Well Under Way.



Only the Head and Forelegs Project.



The End.

HOW SNAKES FEED.

HOW SNAKES FEED.

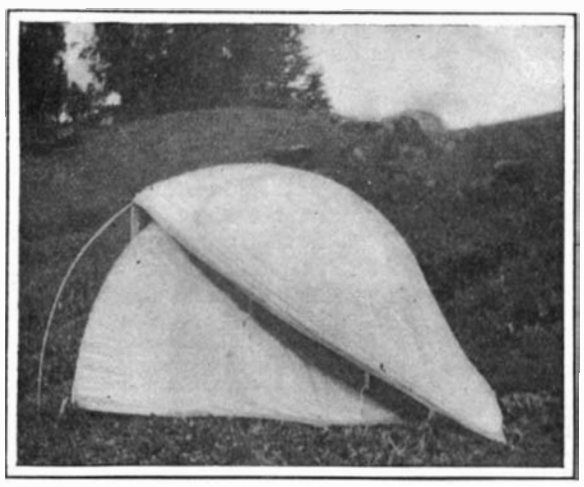
The manner in which snakes procure and consume their food is of ever-recurring interest to all of us, but as this detail of natural history is known to nearly everyone, the accompanying illustrations require little explanation. In the first of the engravings is depicted the rather dignified but nevertheless determined advance of the reptile upon its victim, in this case a good-sized frog, whose attitude denotes an indifference to be followed by dire results later. In the second photograph the frog is shown making desperate efforts to escape from the snake, which has seized the unfortunate by the hind leg, after the sudden dart in which the gradual approach culminated. The third photograph shows the act of swallowing the prey well under way, while in the next the frog has been so far consumed that only the head and fore-legs project from the mouth of the reptile. In this and in the last illustration, the remarkable distending powers of the elastic jaws of the snake are shown; and if we compare the head of the reptile in the first and last photographs, we find it difficult to believe that the creature is the same in both instances. That the swallowing of the frog was not a very difficult performance is demonstrated by the fact that from the positions of the snake in the last three pictures, it apparently was obliged to move only the fore part of its body while at the latter stages of the meal.

A NOVEL TENT.

BY EMILE GUARINI.

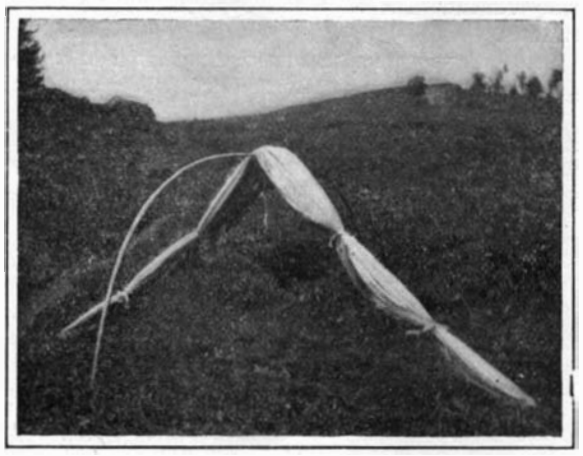
A most interesting tent has recently been constructed by Mr. Frank H. Gotsche, of San Francisco, Cal. The tent is remarkable for its portability. It is easy to pitch and fasten, and is not easily blown down. The shape is very convenient. For the amount of canvas used a remarkably large capacity is obtained.

The frame is made up of four wooden sections. These frame sections are held together by metal sleeves or couplings. When ready to pitch the tent, the frame is drawn into a semi-circle and the ends stuck into the ground four to six inches. The cover is then stretched out and drawn over the frame.

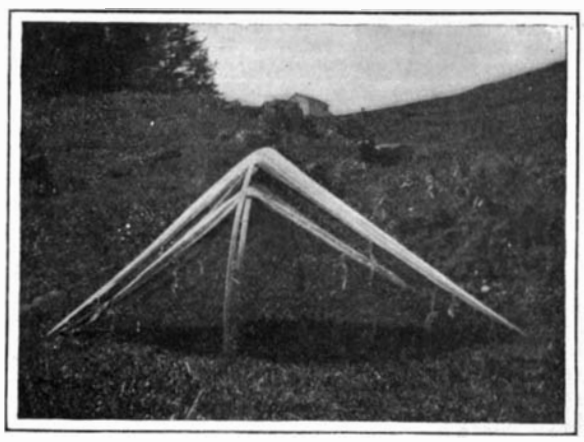


Side View of the Tent.

Double Tent Half Open.



Ready for Transportation.



Entrance to Double Tent.

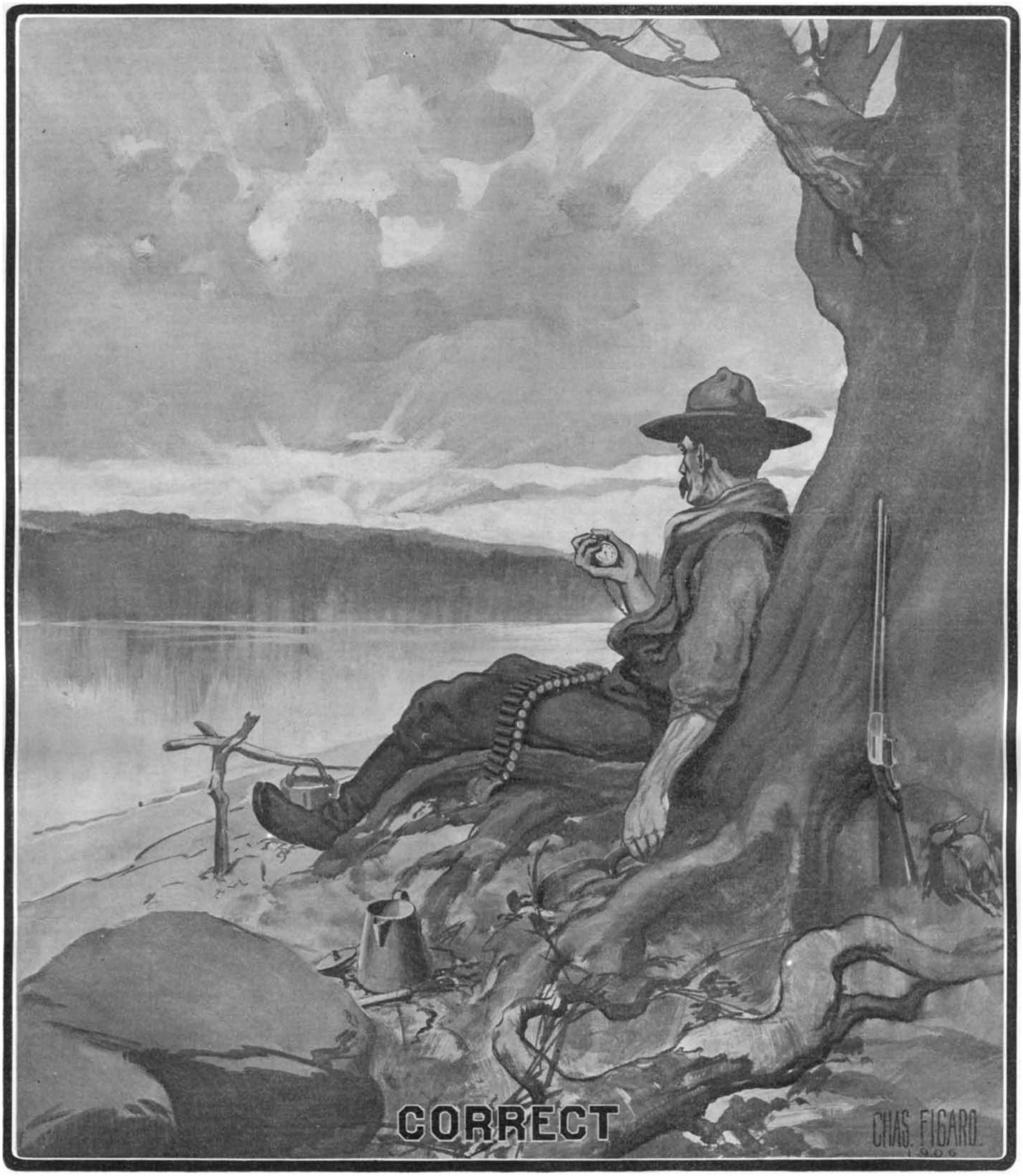
A NOVEL TENT.

A peculiarly advantageous feature of this tent is the fact that a tent of one or two sizes larger can be set over another without touching the smaller tent at any point, thus leaving a complete compartment of air around the inner tent six to twelve inches deep. All who have had to live in permanent camps or in places where the temperature was subject to frequent and great changes will appreciate what this means. This complete air compartment serves as a perfect protection against either heat or cold.

In ordinary weather only two pegs are necessary to stake it. When exposed to a strong wind, more pegs may be used.

New Manufactory for Computing Scales.

A large factory for the manufacture of computing scales is about to be built near Asheville, N. C., by C. F. Christopher, who is the inventor of nine different kinds of these automatic weighing devices. The inventor comes from the western part of Pennsylvania, and while employed as a railroad brakeman, devised an improvement in the locks used on turntables. After he had perfected this invention he disposed of it for $3,500. He turned his attention to other inventions, and made several improvements of different kinds, but the computing scale was the most promising, so that he followed this up with a number of others, and surrounded himself with quite a large business. A local newspaper is authority for the statement that this invention realized $57,000 for the inventor.



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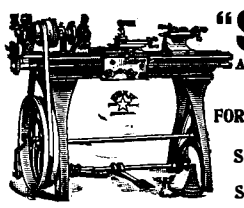

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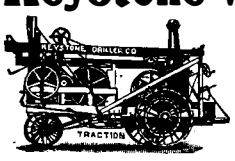

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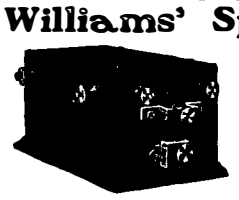

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RECENTLY PATENTED INVENTIONS.

Of Interest to Farmers.

FENCE-POST.—G. R. WYATT, Redwood City, Cal. One object of this case is to provide a metal fence-post well adapted for receiving and supporting fence-wire material, that may be either separate wires or material woven from wires. A further object is to provide novel means which co-operate with the posts for stretching and locking fence material upon a plurality of novel posts. Also braces for supporting the fence-posts and for maintaining the fence-wire material stretched taut; also protecting-casing for the base portion of the posts.

STACKER FOR GRAIN OR THE LIKE.—J. H. BULLOCK, Millerton, Kan. Mr. Bullock employs a stacker comprising a base-section of special construction, in connection with which is employed a crown or superposed section of special construction, imparting to the completed stock of grain, hay, or the like a contour or shape resulting in the effectual shedding off of rain or snow from the upper part of the stack and at such a distance from the base of the stack as to prevent material of the stack from being affected or injured thereby.

Of General Interest.

CONFORMER-CORSET.—C. MUNTER, New York, N. Y. One purpose of the invention is to so construct the health brace-corset that it will conform to and fit the body practically as smoothly as the natural skin, the shaping of the various parts being devoted to that end, especially at the armholes and shoulders, so that when the corset is tightened up upon the person it will gradually restore the bones and muscles at the chest, shoulders, and back to normal position, smooth the skin, and cause the lungs and bronchial tubes to be unobstructed, thus permitting regular easy breathing.

STAIR STRUCTURE.—M. PLOTKIN, New York, N. Y. This invention relates to improvements in the construction of sheet-metal stairs, the object being to provide a metal stairs with a means for securing rock-asphalt, concrete, or the like on the treads in such a manner as to prevent breaking or cracking thereof.

FEED-BAG.—J. A. SKINNER, Denver, Col. One purpose of the inventor is to provide a bag for animals, particularly horses, which will be simple, durable, and economic and so constructed as to effectually prevent waste of feed and so that free and perfect ventilation is obtained. The bag is self-accommodating to different sizes of heads and permits an animal to have perfect freedom in raising and lowering the head.

WATERPROOF EYEGLASS-CASE.—MIRIAM DAVIDSON, New York, N. Y. The article is intended to be used especially by bathers, and while intended especially for carrying eyeglasses it is intended also as a receptacle for articles such as smelling-salts or a vial of brandy, which may be used in an emergency. The case is water-tight and attractive in appearance.

CARRIER FOR PHOTOGRAPHIC PLATES.—E. L. HALL, New York, N. Y. One purpose of the inventor is the provision of a receptacle in which the plates may be placed and supported on end, it being adapted to contain liquid, so that the plates may be transported in a wet condition, enabling them to be subsequently thoroughly washed and preventing the possibility of the hypo drying on the plates and staining them during transportation.

SHINGLE-PRESS.—J. W. THURSTON, Maple Falls, Wash. Mr. Thurston's invention is an improvement in shingle-presses, and his object is to provide a novel construction by which to re-press or tighten-up bundles of shingles for shipping after they have come from the dry-kiln. The bundles may be pressed tightly together without injury to the shingles, and means are provided by which the short lap of the shingles at the middle of the bundles enables them to dry out much more rapidly than when a greater lap is made at the middle of the bundles.

PIN-RETAINER.—W. C. MAYNARD, Miami, Fla. This device is adapted for application to a scarf or hat pin for preventing its accidental or surreptitious detachment. To apply the retainer to a pin or remove it therefrom, the notched end is held disengaged from the pin and the end provided with an opening at one end of a curved spring is slid upon the pin, and when the retainer has been adjusted to desired position the notched end is placed in engagement with the pin, whereby the retainer as a whole is put under tension.

OUTSIDE DRY-EARTH CLOSET.—J. R. KOONS, Huntington Mills, Pa. The said invention has for its object to provide for supplying coal-ashes, earth, or suitable material to the excrement contained in the box or chamber of the closet or privy as an absorbent for such excrement, rendering the latter odorless and otherwise desirable from a sanitary point of view.

LIQUID FORCING OR PUMPING DEVICE.—L. J. C. LARSEN, New York, N. Y. More especially this invention has reference to devices for forcing or pumping temperature-reducing liquids—as alcohol, for instance—into and through the gas-service pipes for houses leading underground from the usual street-main of the gas-distributing system for the purpose of relieving the passage through the service-pipe when the same has become choked or stopped up by the freezing or congelation of moisture therein.

SAFETY-RAZOR.—P. A. BENET, Boston, Mass. The object of the inventor is to provide a razor which can be conveniently carried in one's pocket and readily adapted for immediate use. A special object is to provide a device of such construction that it will have little tendency to wear the lining of a pocket and which will also occupy a small space.

Machines and Mechanical Devices.

SIDE BRACE OR ANCHOR FOR DREDGERS.—J. P. KARR, Monticello, Ind. By means of this attachment for dredging-machines, particularly such as are adapted for excavating canals, Mr. Karr provides a side anchor which not only prevents lateral movement of the screw, but also movement either forward or back, and also the anchoring attachment proper may be quickly and conveniently raised and locked whenever required, and also it may be instantly unlocked and turned again into working position.

ROTARY FOR OIL-WELLS.—H. D. BERNARD, Beaumont, Texas. The invention relates to pipe-rotaries such as used in sinking oil-wells. The object is to produce a rotary of this class which will enable the application of power in the screwing together or unscrewing of the pipe-sections which constitute the casing of the well.

CUTTING AND MEASURING MACHINE.—A. P. SWEENY, Helena, Mont. The invention relates to apparatus for cutting and measuring fabrics and like sheet material, it being particularly adapted for trimming window-shade cloth and dividing it into definite lengths to furnish the shades. It will successively cut and measure lengths automatically and perform either of these operations separately.

OIL-CLOTH-PRINTING MACHINE.—W. H. WALDRON, New Brunswick, N. J. The improvement refers to machines for imprinting a design in various colors upon oil-cloth and other fabrics by the use of intermittently-reciprocating printing-blocks. The object is to provide a machine arranged to insure solid impressions with a comparatively small amount of color.

BEAMING-MACHINE.—F. A. BAER, Paterson, N. J. It is the essential object of the inventor to provide means for automatically cutting out the picks as the warp is beamed, leaving only short lengths in the warp, which may be readily removed by the weaver. In attaining this end Mr. Baer prefers to provide the machine with a number of automatically-operating knives, which run between the warp-threads and as the picks approach the knives serve to sever the same.

MOLDING-MACHINE.—H. C. STEELE, W. STENSON, and F. J. TROUT, Jacksonville, Fla. The principal objects of the invention are to provide means for smoothing the sides of the molded articles as they are removed from the mold, to provide for quickly and efficiently removing them from the molds, to provide for attaching two articles together by means of an insert placed in them in the act of molding, to provide for a convenient and efficient introduction of the molding material into the molds, and to provide for adjustments to accommodate one set of molds to articles of different lengths. It relates to improvements in machines and molds for molding plastic materials.

Railways and Their Accessories.

AUTOMATIC AIR-COUPLING.—E. V. SEXSMITH, Fond du Lac, Wis., and D. E. MOULTON, Belle Plaine, Iowa. The improvement pertains to a coupler for use upon either passenger or freight trains; and the principal objects thereof are to add to the efficiency without increasing the cost of these devices and to provide a construction which will operate effectively to conduct air from one car to another, as well as to provide for the automatic coupling of the parts and to secure means for allowing adjustment to suit various kinds of cars.

SIGNAL.—C. R. DOWLER, Lamar, Col. More definitely stated the invention refers to means indicating dangerous high-water level at a railroad or other bridge. The object had in view is to provide a signal involving new, improved, and simplified means for effecting the display of a visual or audible signal indicating dangerous high level of the water in a river at a bridge or other place.

Pertaining to Recreation.

AMUSEMENT DEVICE.—E. S. BENEDICT, New York, N. Y. The principal object in this case is to provide an artificial flow of water directly in line and falling over the track upon which the vehicle moves and for shutting off the flow as the vehicle enters it and then starting flow again when vehicle has passed. This is accomplished, first, by having the flow represent a waterfall, second, by having it represent a fountain. Either can be electrically lighted in any of the ordinary ways or can be provided with any features employed for beautifying artificial falls and fountains.

FISHING-REEL.—F. L. DICKSON, El Paso, Texas. This invention relates to fishing-reels such as are used by anglers for "playing" a fish after it has been struck. The object of the inventor is to produce a reel of simple con-

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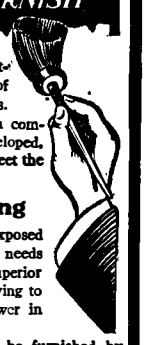

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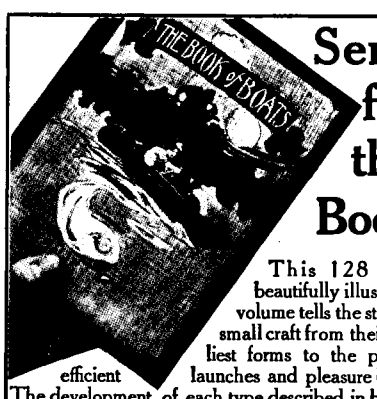

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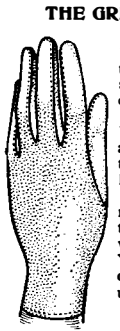

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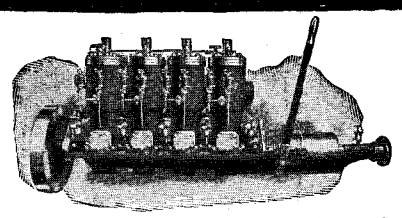

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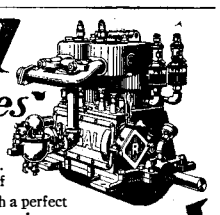

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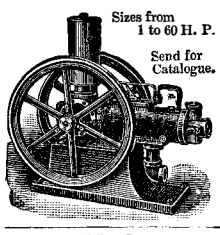

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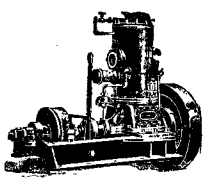

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Pertaining to Vehicles.

AUTOMOBILE.—B. E. HERVEY, Spokane, Wash. The invention is an improvement in automobiles. By supporting the wheel-shaft upon either side of the wheel and by providing the oppositely-disposed crank-arms arranged upon either side of the longitudinal bar all cross strain is obviated, and as a consequence friction is reduced to a minimum. A better and more equal transmission of power is also effected by this arrangement, and a more stable support is provided for the wheels.

TRUCK.—J. D. SMITH, Cheraw, S. C. Mr. Smith's invention relates to trucks especially adapted for handling lumber in mills and elsewhere; and the purpose of the improvement is to provide a truck in which the frame is in one piece, and, further, in which the axles are of such construction as to act as braces and spreaders for the frame as well as axles.

VEHICLE.—J. H. HANSON and J. J. PETRABORG, Aitkin, Minn. The improvement has reference to vehicles, and more particularly to the running-gear thereof. Its principal object is to equalize the movement of said gear. Used in connection with automobiles it will relieve the engine and its associate parts to a great extent from ordinary wear and tear incurred. It will greatly reduce the liability of upsetting a vehicle or displacing its load.

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(9894) F. G. H. asks: Will the range (actual and theoretical) of a 30-caliber bullet (any other caliber probably would not matter) fired from a gun weighing ten pounds suspended by a wire, i. e.—free to recoil without friction—be the same as a bullet of the same caliber fired from a gun having an equal bore and similarly suspended, but having a weight or mass of 10,000 pounds? This has puzzled the writer and a number of his friends who are readers of your valuable paper. Any light you can throw on the subject, together with explanation of how you arrive at the correct solution will be greatly appreciated. A. Newton's Third Law of Motion is, "The mutual action of two bodies is equal and opposite in direction;" or, as it is usually expressed, "action and reaction are equal and opposite in direction." The action of the gases upon the gun and the ball are equal in quantity, and each has the same momentum, the ball forward, the gun in the opposite direction. No account need be taken of the weight of either unless the velocity of the two need be determined. The velocity of recoil of the guns will be in proportion to their weight.

(9895) J. K. asks: How cold is it when it is twice as cold as two degrees above zero? The above problem appeared in a publication recently, which caused considerable discussion. Some considered it as a joke, and others more serious. Following issues published different solutions. If I may be permitted to trespass upon your time, please favor by answering the above problem if possible. A. It is not twice as cold when it is one degree above zero, F. as it is at two deg. above zero. To get an absolute comparison of temperature we must measure from absolute zero. Temperatures above absolute zero correspond to the heat required to produce them. Two above absolute zero is twice as hot as one above. Absolute zero is 459 deg. Fahr. below its zero. The real temperature when the Fahr. thermometer shows 2 deg. above is 461 deg. absolute Fahr. Twice as cold, or as it should be expressed, half as hot as this, is 230.5 deg. absolute Fahr.

(9896) S. R. says: I have a maximum and minimum thermometer, the principle of which I find it difficult to understand, and so far have not been able to find any description in any books that I have. It is the bent tube thermometer, containing quicksilver, but with no bulb as a reservoir of the metal. It carries two glass rods with iron pins in them, which mark the maxima and minima, and which are drawn back to place by means of a small horseshoe magnet. A. The thermometer which you describe is a Six's thermometer. The liquid is usually the same on both sides of the mercury, and is usually alcohol. A space above the alcohol in the bulb has in it only vapor of alcohol. When the temperature rises, the expansion of the alcohol in *A* pushes the mercury and the iron wire above the mercury in *B* along to the highest point reached by the mercury. When the temperature falls, this wire is left at the highest point it has reached, the alcohol contracts in *A* and draws the mercury over to the side *A*. The iron wire is not pushed in front of the mercury in *A* to the lowest temperature reached by the contraction of the alcohol in *A*. The thread of mercury is the indicator; the change of volume of the alcohol measures the change of temperature.

(9897) W. A. W. asks: Can it be proved that light is not electrical energy generated by the sun, which energy in coming in contact with the resistance of the earth's atmosphere produces light by friction? Does the wireless telegraph operate through waves of ether or waves of air? A. Scientists believe that light is due to the same waves as electricity, and that these come through space, from any body which can produce them, to the earth. When these waves strike the earth, they are ultimately absorbed as heat waves. If they strike an eye, they are converted into light waves. Any object which is hot enough can emit such waves. Objects which can reflect these waves may send them to the eye, as flowers and other visible objects on the earth do send them. Friction is not involved in the action. Wireless telegraphy is performed by waves which are electro-magnetic in character, and which pass through air or ether on their way, supposedly with the speed of light.

(9898) W. O. D. asks: Should it be practicable to convert the alternating machine, described by N. Monroe Hopkins in SUPPLEMENT No. 1558, by making proper connections with regard to the field and using a separate commutator with the necessary connections in armature. Please advise me as to size of wire to use in both field and armature, together with any other information you have time to give me. A. No change in field or armature winding is necessary to convert the alternating-current dynamo of SUPPLEMENT No. 1558 into a direct-current machine. It is only necessary to replace the collecting rings by a commutator with as many segments as there are coils on the armature, and connect the end of one coil and the beginning of the next coil of the field to the bars of the commutator in regular order around the commutator. The machine will then give a direct current.

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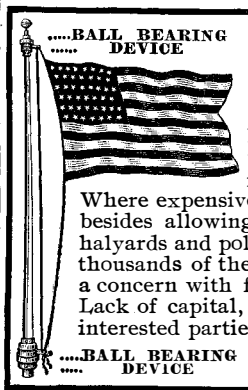

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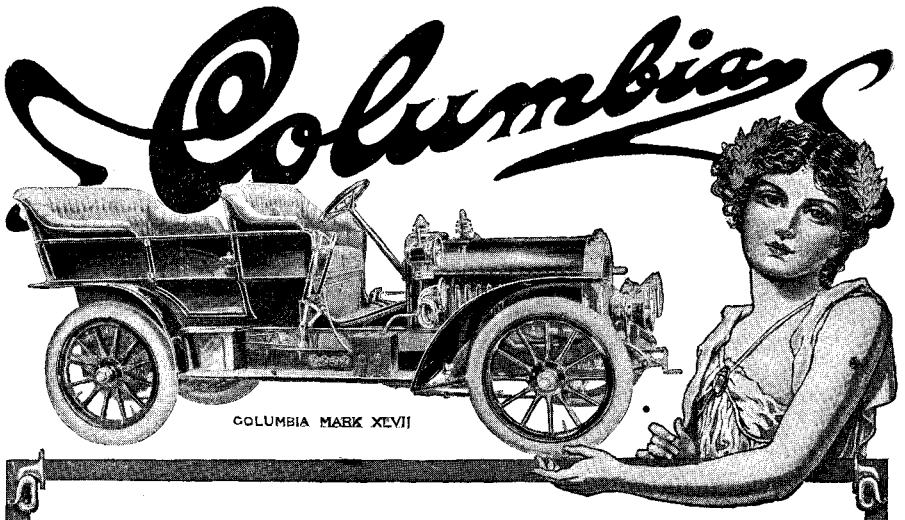

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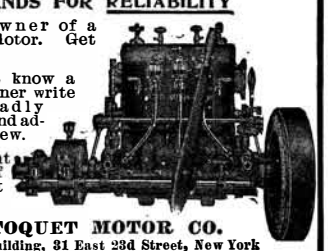

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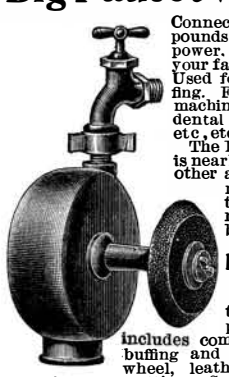

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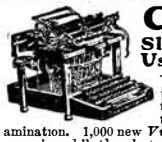

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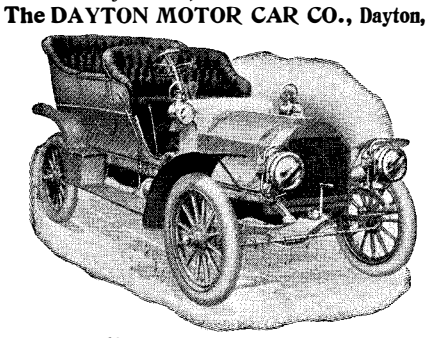

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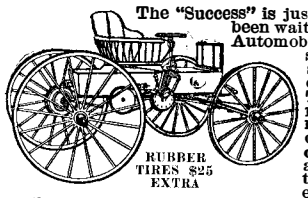

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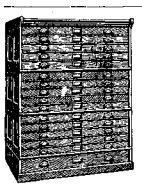

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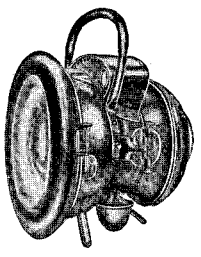

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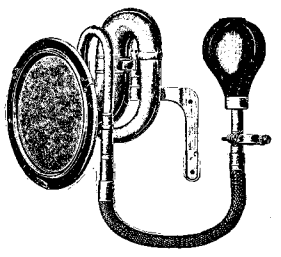

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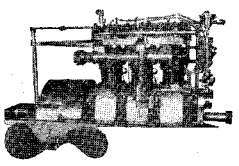

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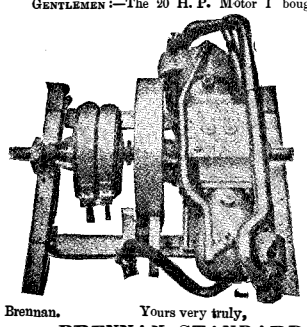

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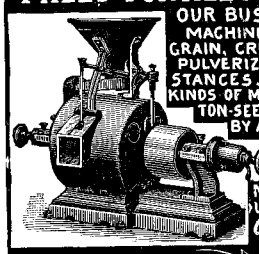

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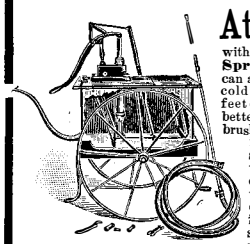

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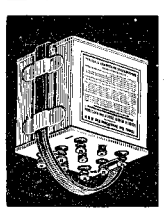

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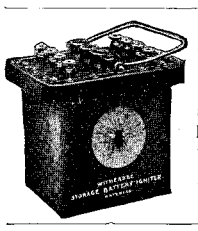

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Whisky, Hoffheimer Bros. Co.	49,818
Wines, S. S. Pierce Co.	49,873
Yeast, crumb, Yost Yeast Co.	49,929

LABELS.

"Bonafid," for toilet paper, Scott Paper Co.	12,680
"Bonnette," for coffee, Fort Smith Commission Co.	12,671
"Callier's Cut Loaf Cream Candy," for candy, J. B. Callier	12,675
"Columbia Phonograph Co., Columbia Record," for sound records, Columbia Phonograph Co.	12,683
"Edstrom's Lung Gas," for medicine, O. E. Edstrom	12,677
"Havana Bit," for cigars, P. Wohl & Co.	12,668
"Hazel Patch," for cigars, O. A. Leistikow.	12,670
"Little Nemo's Barefoot Sandal," for sandals, H. Jacobs & Sons	12,681
"McCarthy's Winner," for dry plates, McCarthy Dry Plate Co.	12,682
"Mrs. Winslow's Borated Violet Talcum," for toilet powder, M. Chubb	12,676
"Penn's Plasters," for adhesive plasters, Penn Chemical Co.	12,678
"Prince's Liniment The Great Panacea," for liniment, A. E. Lynch	12,679
"61," for cigars, Bethany Cigar Co.	12,669
"Soda Mint Water," for carbonated water, Soda Mint Water Co.	12,672
"Sponge-Ate The Greatest Bait," for confectionery, Hook & Crownfield	12,674
"Syreet," for syrup, C. H. Keyes	12,673

PRINTS.

"Adler's Spring and Summer Clothes," for men's spring apparel, David Adler & Sons Clothing Co.	1,580
"An Easy Shave," for shaving soap, O. F. Woodward	1,576
"Fit-Easy," for shoes, A. S. Bacon	1,578
"Hammer the Hammer," for revolvers, Iver Johnson's Arms and Cycle Works	1,581
"Men's Apparel," for men's apparel, W. C. Both	1,579
"Sauer's Famous Flavoring Extracts," for flavoring extracts, C. F. Sauer Co.	1,573
"The Delicious," for candy, Rochester Candy Works	1,575
"The First Hands," for flour, Washburn Crosby Co.	1,574
"The Knox-All Hat," for hats, F. A. Lux	1,577

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

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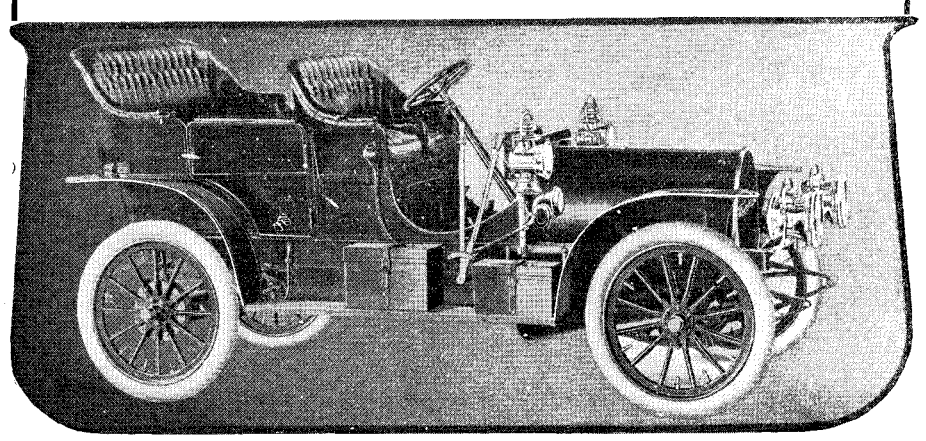

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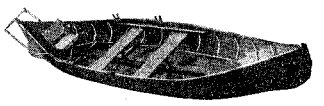

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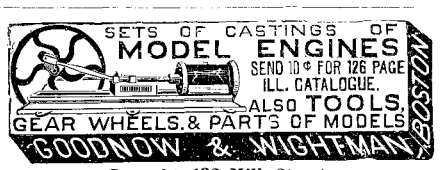

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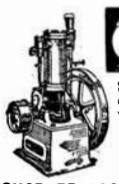

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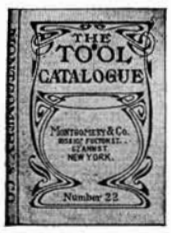

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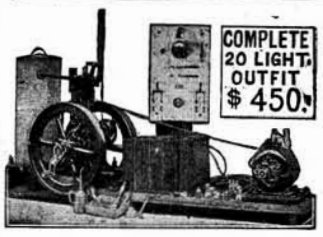

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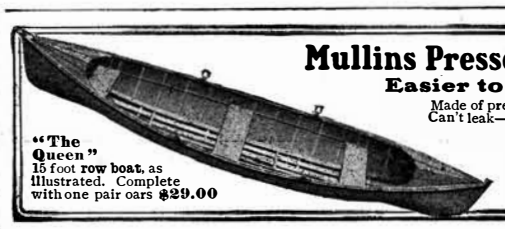

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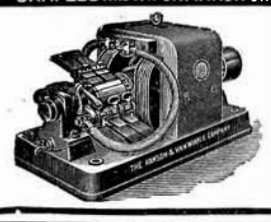

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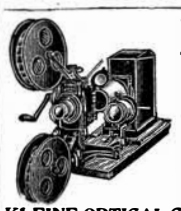

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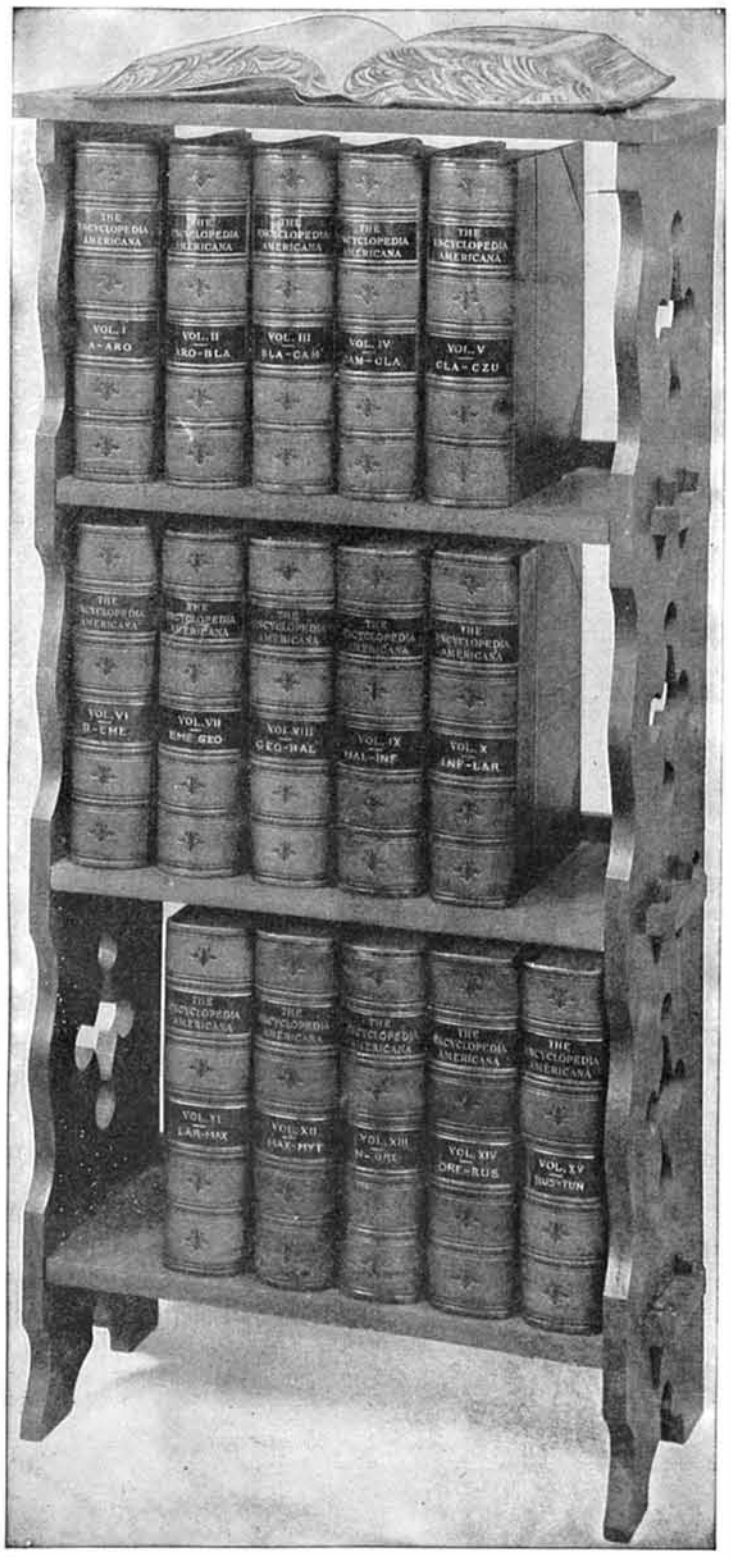

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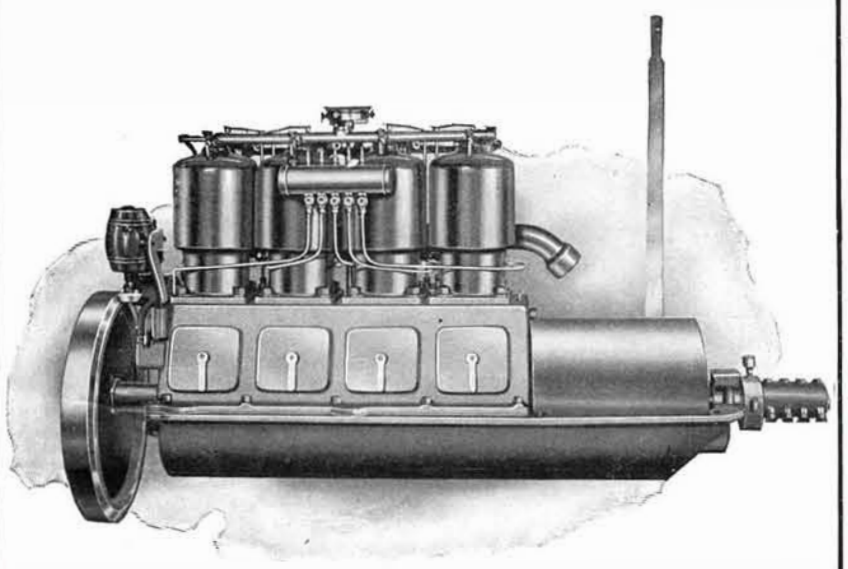

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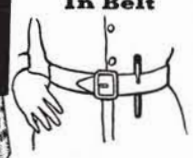

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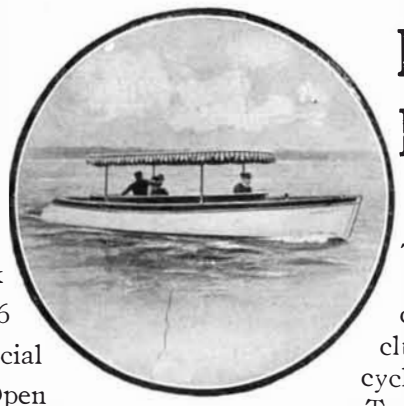

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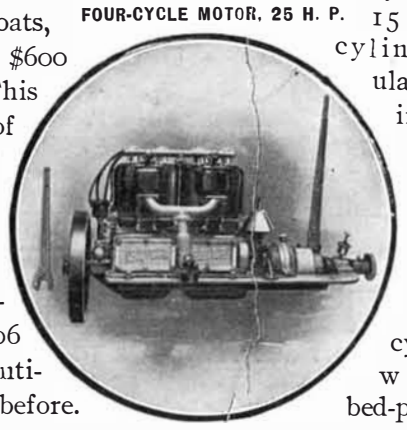

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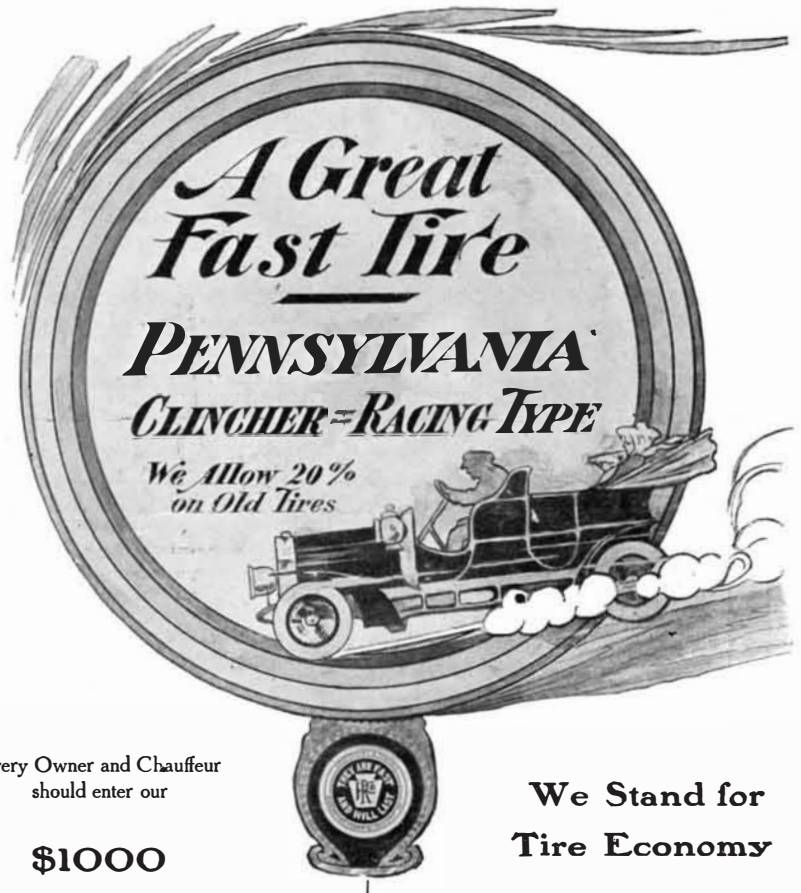

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